EVALUATION OF MARGINAL ADAPTATION AND MICROLEAKAGE OF TWO DIFFERENT TYPES OF ZIRCONIA CROWNS WITH THAT OF A GLASS CERAMIC CROWN LUTED WITH RESIN CEMENT: A COMPARATIVE IN VITRO STUDY.

Dissertation submitted to

The Tamil Nadu Dr.M.G.R. Medical University

In partial fulfilment of the degree of

MASTER OF DENTAL SURGERY

BRANCH I

PROSTHODONTICS AND CROWN & BRIDGE

2014-2017

CERTIFICATE

This is to certify that the dissertation entitled "**Evaluation of marginal adaptation and microleakage of two different types of zirconia crowns with that of a glass ceramic crown luted with resin cement – A comparative in vitro study"** is a bonafide record of the work done by Dr.P.Rajkumar Post graduate student during the period 2014-2017 under my guidance and supervision. This dissertation is submitted in partial fulfilment of the requirements for the award of MASTER OF DENTAL SURGERY IN, BRANCH I (PROSTHODONTICS AND CROWN AND BRIDGE) under THE TAMIL NADU Dr.M.G.R MEDICAL UNIVERSITY, GUINDY, CHENNAI. It has not been submitted (partial or full) for the award of any other degree or diploma.

GUIDE

Dr.T.SREELAL, M.D.S

Professor and Head,

Department of Prosthodontics,

Sree Mookambika Institute of Dental Sciences,

Kulasekharam

CO-GUIDE

Dr.Aparna Mohan, M.D.S

Reader,

Department of Prosthodontics,

Sree Mookambika Institute of Dental Sciences,

Kulasekharam

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES

(Kulasekharam (K.K District, TN)-629161, Phone No: 04651-280866, Fax No: 280740)

Institutional Human Ethics Committee (IHEC)

{CDSCO Reg No: ECR/446/Inst/TN/2013}

Ref. No: SMIMS/IHEC/2015/A/36 **Date: 17th February 2016**

CERTIFICATE

This is to certify that the Research Protocol Ref. No. **SMIMS/IHEC/2015/A/36** entitled "Evaluation of Marginal Adaptation and Microleakage of Two Different Types of Zirconia Crowns, with that of a Glass Ceramiccrown, Luted with Resin Cement – A Comparative *in vitro* Study" submitted by Dr. Rajkumar. P, Postgraduate of Department of Prosthodontics and Implantology, SMIDS has been approved by the Institutional Human Ethics Committee at its meeting held on 22nd December 2015.

17/2/16

Dr. Rema Menon. N
Member Secretary
Institutional Human Ethics Committee
Professor and HOD of Pharmacology
SMIMS, Kulasekharam (K.K District)
Tamil Nadu-629161

IHEC
Date 17/2/16

[This Institutional Human Ethics Committee is organized and is operating according to the requirements of ICH-GCP/GLP guidelines and requirements of the Amended Schedule-Y of Drugs and Cosmetics Act, 1940 and Rules 1945 of Government of India.]

SREE MOOKAMBIKA INSTITUTE OF DENTAL SCIENCES

KULASEKHARAM, KANYAKUMARI DIST., TAMIL NADU, INDIA.

INSTITUTIONAL RESEARCH COMMITTEE

Certificate

This is to certify that the research project protocol, ***Ref no. 16/06/2015*** titled, ***"Evaluation of marginal adaptation and microleakage of two different types of zirconia crowns, with that of glass ceramic crown, luted with resin cement- a comparative in vitro study"*** submitted by ***Dr. P. Rajkumar, II Year MDS, Department of Prosthodontics and Implantology*** has been approved by the Institutional Research Committee at its meeting held on 15th ***June 2015.***

Convener
Dr. T. Sreelal

Secretary
Dr. Pradeesh Sathyan

Tele : 0471-2340801
Fax : 0471-2341814

Website : www.sctimst.ac.in
E-mail : bmtwing@vsnl.com

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बायो मेडिकल टैक्नोलॉजी विंग
पूजापुरा, तिरुवनन्तपुरम-695 012, इन्डिया

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY
BIO MEDICAL TECHNOLOGY WING
POOJAPPURA, THIRUVANANTHAPURAM-695 012, INDIA
(An Institute of National Importance under Govt. of India)

Ref:

Date: 8.12.2016

Certificate

This is to certify that **Dr.P.Rajkumar** (Post Graduate Student, In Department of Prosthodontics and Implantology at Sree Mookambika Institute of Dental Sciences, Kulasekaram) has carried out Scanning Electron Microscopy analysis in our lab as a part of his MDS dissertation titled **"Evaluation of marginal adaptation and micro leakage of two different types of zirconia crowns, with that of glass ceramic crown, luted with resin cement- A comparative in vitro study"**.

Dr Manoj Komath
Scientist-in-Charge
SEM Lab

Dr. MANOJ KOMATH, PhD
Scientist F & In-charge, Bioceramics Division
Dept of Biomaterials Science and Technology
Biomedical Technology Wing, SCTIMST
Poojappura, Thiruvananthapuram-695 012

DECLARATION

I hereby declare that this dissertation "**Evaluation of marginal adaptation and microleakage of two different types of zirconia crowns with that of a glass ceramic crown luted with resin cement – A comparative in vitro study".**is a bonafide record of work undertaken by me during the period 2014-2017 as a part of post graduate study. This dissertation, either in partial or in full, has not been submitted earlier for the award of any degree, diploma, fellowship or similar title of recognition.

Dr.P.Rajkumar,
MDS Student,
Department of Prosthodontics,
Sree Mookambika Institute of
Dental sciences,
Kulasekharam,
Kanyakumari Dist,
Tamil Nadu

SREE MOOKAMBIKA INSTITUTE OF DENTAL SCIENCES, KULASEKHARAM

ENDORSEMENT BY THE PRINCIPAL / HEAD OF THE INSTITUTION

This is to certify that the dissertation entitled **“Evaluation of marginal adaptation and microleakage of two different types of zirconia crowns with that of a glass ceramic crown luted with resin cement – A comparative in vitro study”.** is a bonafide research work done by Dr.P.Rajkumar under the guidance of Dr.T.Sreelal, M.D.S, Professor and Head, Department of Prosthodontics and Crown and Bridge, Sree Mookambika Institute of Dental Sciences, Kulasekharam.

Date:

Dr.ElizabethKoshi, MDS,

Principal,

Sree Mookambika Institute

of Dental Sciences,

V.P.M Hospital Complex,

Padanilam, Kulasekharam,

Kanyakumari District,

Tamil Nadu - 629161

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
Co-Cr	Cobalt chromium
Ni-Cr	Nickel chromium
HF	Hydrofluoric acid
SEM	Scanning Electron Microscope
FPD	Fixed partial denture
ZrO_2	Zirconium dioxide
PCR	Partial coverage restoration
CAD	Computer aided design
CAM	Computer aided manufacturing
Y-TZP	Yttria-stabilized zirconia

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ABSTRACT

INTRODUCTION:

An alternative to metal ceramic restoration is the All Ceramic restoration. The use of All Ceramic restorations has substantially increased over the last 20 years for the restoration of anterior and posterior teeth. In achieving an aesthetically and functionally ideal restorations, three main factors- aesthetic value, resistance to fracture and marginal adaptation are responsible for success of every dental restoration. However, the longevity of fixed prosthodontics depends upon the quality of the marginal adaptation to the abutment teeth.

Inadequate marginal adaptation lead to plaque accumulation which increases the risk of carious lesions, in turn can cause microleakage and endodontic inflammation and finally terminates to periodontal diseases.

Here, the purpose of the present study is to evaluate the marginal adaptation and microleakage of different types of metal-free ceramic crowns.

AIMS AND OBJECTIVES:

1. Comparison of marginal adaptation of two different types of zirconia crowns, with a glass ceramic crown.
2. Comparison of microleakage of two different types of zirconia crowns, with a glass ceramic crown.

METHODOLOGY:

In the present study, maxillary first premolar is prepared to receive All ceramic restoration and impression made using addition silicone putty to make wax tooth replica then it was casted for a cobalt-chromium tooth model. 30 heat cure acrylic replicas are fabricated from the metallic die. Then 30 All Ceramic crowns were fabricated for the heat cure acrylic tooth models [20 zirconia crowns - 10 of each system and 10 glass ceramic crowns]. The experimental group were divided according to the types zirconia and glass ceramics into 3 groups.

The constructed All ceramic crowns were luted to the acrylic tooth models using self adhesive resin luting cement. The luted crowns were dipped into 0.1% methylene blue solution. Sectioning of luted crowns were done by diamond wheel disc of 0.01mm thickness.

The marginal discrepancy between the All ceramic crowns were then measured with scanning electron microscope at magnification of 400X.

Microleakeage were measured with stereomicroscope of 4X magnification. The measurements were made at buccal and lingual cervical margins. The images were captured and later transformed to the computer.

RESULTS

The results of the study indicated that IPS e-max (pressable glass ceramics) crowns have less marginal gap and microleakage compared to LAVA Zirconia crowns and DENTCARE Zirconia crowns

SUMMARY AND CONCLUSION

Based on the observations in this study, it was concluded that IPS e-max (pressable glass ceramics) crowns have less marginal gap and microleakage. However further clinical research is suggested in order to prove it as a reliable and successful treatment modality.

INTRODUCTION

Science and technology with its array of inventions and discoveries in the material science along with art and culture in its divergent forms have contributed greatly in the quest of achieving aesthetic excellence. In Prosthodontics porcelain has found primadonna position in achieving aesthetic realism. The substantial increase in aesthetic consciousness, concerns about toxic and allergic reactions to metal restorations has led to a rapid development of restorative dental materials. Superior aesthetic requirements are no longer a luxury. It is the everyday basic need that has pushed dental materials to the edge of its limitations.

Apart from aesthetics, yet another factor that determines the long term success of a restoration is its marginal adaptation to the tooth structure.

A die-spacer (die relief) is often used in the fabrication of crowns to provide space for the luting cement. This space helps to reduce the resistance of the cementing material to flow, which facilitates the complete seating of the restoration and helps to ensure that the cement is extruded from beyond all preparation margins, thereby providing a good marginal seal. The resistance of cementing materials to flow may result in a crown that does not fully adapted. This may create marginal discrepancies that will lead to microleakage.

Classically defined, microleakage is the diffusion of substances, such as bacteria, oral fluids, molecules and/or ions into a fluid-filled gap or into a structural defect that is present or one that occurs between restorative materials and tooth structure.

Aesthetically oriented modern dentistry frequently utilizes high strength, biocompatible All-ceramic materials to satisfy the clinical demand of a patient. However, all these materials have to meet with three important criteria like high fracture resistance, aesthetics and marginal fit for long-term survival in the complex oral environment. The marginal fit of the All-ceramic systems can be a critical factor to its long-term success. Inaccurate marginal adaptation is potentially detrimental to the tooth and the supporting periodontal structures.

Metal-ceramic materials possess adequate mechanical properties, but often lack the superior aesthetics. Gingival discolouration surrounding the margins or even metal exposure due to gingival recession has been a common un-aesthetic and undesirable outcome.

It was assumed that well known gingival reactions and eventual tissue biological incompatibility to metal often observed in all-metal or porcelain fused to metal restorations will be completely eliminated with all-ceramic crown replacement. Any dental material requires sufficient physical properties to achieve good aesthetic results, marginal integrity and high strength to withstand an occlusal load.

Increased aesthetic demand and improved technology led to the introduction of All-ceramic crowns. **Charles Land** described one of the first methods for an all porcelain jacket crown. These highly aesthetic crowns yielded low strength and were limited to the anterior for placement with frequent failures. **McLean and Hughes** were the first to introduce a higher strength ceramic core material to decrease the fracture potential and crack propagation under low impact stress by reinforcing porcelain restorations using an aluminous ceramic core material.

From this initial success, full ceramic crowns have been further developed and modified by employing different materials and cores to improve the overall strength and aesthetics. Initially, it was hoped that leucite would improve the strength of all ceramic crowns, but it provided much less than anticipated. Metal oxides, such as zirconia and magnesia, were developed, showing dramatically improved strength, yet creating opaque restorations.

Lithium disilicate is a popular new material that has been studied heavily over the last few decades. It is a strong and aesthetic material that can be used in the anterior and posterior, is a core for feldspathic porcelain or a full crown. When used as a monolithic crown, it may only require a reduction of 1.0-1.5 mm, similar to cast metal crowns.

There have been different developments in the techniques used to make all-ceramic crowns affecting fit on the preparation or at the margin. Technology has allowed crowns to be pressed, using a similar method to casting, and be milled out of a block of dense material with the aid of CAD/CAM. These methods have helped increase efficiency and ease of ceramic crown fabrication, as well as reduce the shrinkage of the material during the fabrication process.

The most important characteristics for long term success of full coverage restorations, including all-ceramic restorations, are good marginal adaptation and adequate strength. The larger the marginal discrepancy, the more the luting material and dentin are exposed to the oral environment, increasing the risk of seal failure and caries due to bacterial infiltration.

Therefore, marginal fit is an important factor in determining short and long term success of a restoration; and if not properly adapted, will likely lead to the disease and potential loss of teeth. An additional factor is the location of the margin with respect to the gingival sulcus. The location of crown margins is typically sub-gingival or supra-gingival. The advantages of supra-gingival margins are cleansability, ease of evaluation, minimal effect on the periodontium, ease of accurate impression capture, polishability at the tooth-crown margin, and easily detectable and removable excess cement.

This showed that if unacceptable crowns are cemented it will cause problems for the patient in the future. Therefore, the ideal marginal location is supra-gingival, especially with newer ceramic materials that mask the margins and blend into tooth structure.

All-ceramic crown systems may be fabricated using different techniques. One of these techniques is the heat-press, which is similar to the method of metal-ceramic crowns, as that also utilizes the lost wax method. The difference of the heat-press is that it involves the use of a special porcelain furnace with a pneumatic ram, which presses the ceramic material into the mold at high temperatures under vacuum. The system produces a high-strength core, consisting primarily of lithium-disilicate glass.

The different materials and applied techniques in the manufacturing of crown systems have significant effects on the strength of the final restoration as well as the marginal fit. All-ceramic restorations must satisfy the clinical requirements in these respects to be considered successful. Minimizing the marginal gap is also necessary because an increase in the marginal gap results in an increase in cement dissolution, thus increasing the potential for microleakage.

Recent introduction and popularity of CAD/CAM designing and production of substructures for fixed partial dentures have minimized the human errors during production stage which can influence the marginal fit of the restorations.

The marginal fit of CAD/CAM restoration is dependent on multiple factors. Clinical and laboratory studies have investigated these different affecting factors, which can contribute to the final fit of cemented All Ceramic copings, such as type of finish line, die spacing and different cements and cementation techniques.

There have been suggestions that scanning, software & machining can also have detrimental effect on the final fit of CAD/CAM produced restoration. Another technique is the computer-aided design and manufacturing (CAD/CAM) system, which focuses on precise and consistent manufacturing of zirconium-di-oxide ceramics with high strength and toughness.

Luting agents’ sealing ability and resistance to the varying stresses are also important factors that influence the extent of leakage. Resin luting systems are also recommended for the cementation of all-ceramic systems. However, the multistep application technique has been reported to be complex and sensitive, which can influence the bonding effectiveness.

Therefore, a new type of luting material, called self adhesive cement, that does not require any pre-treatment of the tooth surface has been developed. This material combines the favourable properties of conventional (zinc phosphate, glass ionomer, and polycarboxylate) and resin cements.

If marginal gaps are one of the primary etiologies leading to gingival inflammation, caries, or eventual non-restorability of a tooth, it is imperative to know which materials can provide accurate fitting to the natural tooth.

The present study is mainly concerned to determine the marginal adaptation and microleakage of two different types of zirconia and to compare them with that of glass ceramic. This is to determine which type of All ceramic would be the best for clinical application and which has better marginal adaptation and less microleakage for the long term success of all ceramic restorations.

AIMS AND OBJECTIVES

AIMS

- To determine the marginal adaptation of two different types of zirconia
- To study the micro leakage of two different types of zirconia
- To compare the marginal adaptation of two types of zirconia with that of glass ceramic.
- To compare the micro leakage of two different types of zirconia with that of glass ceramic.

OBJECTIVES

- To compare the marginal adaptation and micro leakage of two different types of zirconia and to compare them with that of glass ceramic.
- To determine which type of All ceramic would be the best for clinical application and which has better marginal adaptation and less micro leakage for the long term success of All ceramic restorations.

REVIEW OF LITERATURE

Ana et al (1999)[1] discussed the current status of luting agents for fixed prosthodontics and stated that adhesion to enamel occurs through the micromechanical interlocking of resin to the hydroxyapatite crystals and rods of etched enamel. Adhesion of resin to dentin is more complex, involving penetration of hydrophilic monomers through a collagen layer overlying partially demineralised apatite of etched dentin.

Gemalmaz et al (2002)[2] evaluated the clinical performance of IPS Empress Crowns. He concluded that of the 37 IPS Empress crowns evaluated, 94.6% were rated satisfactory according to CDA criteria within an average clinical evaluation period of 24 months.

Guazzato et al (2002)[3] assessed the Mechanical Properties of In-Ceram Alumina and In-Ceram Zirconia and stated that Zirconia exists in three major phases: the cubic phase, the intermediate tetragonal phase and the monoclinic and that this transformation may be initiated by stress surrounding the crack tip, resulting in partial closure of the crack and imparting significant toughening to the ceramic material.

Zasshi et al (2003)[4] discussed the marginal fitness of tetragonal zirconia polycrystal all-ceramic restorations and concluded that Tetragonal zirconia polycrystals stabilized with 3 mol-% yttria (TZP) exhibit good mechanical properties, favourable aesthetic appearance and translucency.

Markus et al (2003)[5] conducted a study on Resin-ceramic bonding and concluded that preferred surface treatment methods for all ceramic restorations are acid etching with Hydrofluoric acid solutions (2.5% to 10% for 2 to 3 minutes) and subsequent application of a silane coupling agent.

Yeo et al (2003)[6] compared the marginal adaptation of single anterior restorations made using different all-ceramic crown systems Celay , In-Ceram, conventional In-Ceram, and IPS Empress 2 layering technique with a control group of metal ceramic restorations and concluded that the marginal discrepancies were all within the clinically acceptable standard set at 120 µm.

Dehailan (2004)[7] concluded that it is very important to consider the available survival data for all-ceramic materials when selecting a treatment strategy and could be very challenging due to the numerous all ceramic systems available and the definition of failure that varies in the literature and he reported that survival rates of all-ceramic restorations range from 88 to 100% after service for 2-5 years, and up to 97% after 5-15 years.

Stappert et al (2005)[8] determined the influence of the preparation design and the dimensions of all-ceramic partial coverage restorations (PCR) on the marginal accuracy before and after masticatory simulation and showed that IPS e-max® Press can be used to fabricate all-ceramic inlays and PCR which meet the requirements in terms of a clinically acceptable marginal gap, irrespective of the preparation design used.

Attia et al (2006)[9] investigated the fracture load of composite resin and feldspathic all-ceramic CAD/CAM crowns and concluded that adhesive cementation increased fracture loads of composite resin and all-ceramic CAD/CAM crowns as compared to conventional cementation with zinc phosphate cement.

Richard et al (2007)[10] concluded that there is a substantial lack of consensus relating to methods used to investigate marginal adaptation of crowns and fixed partial dentures and stated that direct view technique is the most commonly used method and recorded the most reproducible results among different studies.

Conrad et al (2007)[11] evaluated the Current ceramic materials and systems with clinical recommendations and stated that Leucite and feldspathic glass ceramics are indicated for onlays, three quarter crowns, and veneers, but their strength limits their use to complete coverage crowns in the anterior segment, only and that Lithium-disilicate glass ceramics can perform successfully in the posterior segment for single crowns and 3-unit Fixed partial prostheses in the anterior area.

Sailer (2007)[12] assessed the 5-year survival rates and incidences of complications of All-ceramic fixed dental prostheses and compared them with those of metal–ceramic Fixed partial prostheses and concluded that the most frequent reason for failure of Fixed partial prostheses made out of glass-ceramics or glass-infiltrated ceramics was fracture of the reconstruction.

Synder (2007)[13] compared the All-Ceramic Restorations Using VITA YZ CAD/CAM Zirconia Veneered with VM9 Porcelain and concluded that the strength of available materials typically dissipates when moving away from the anterior teeth to begin restoring the posterior region.

Radovic et al (2008)[14] evaluated the Self-adhesive Resin Cements and concluded that adhesion to enamel appears to be a weak link in bonding properties of self-adhesive cements.

Pilathadka et al (2008)[15] determined the Marginal Adaptation of the Incisor and Molar Procera all Ceram Crown Copings and stated that Clinical and laboratory studies have investigated the different factors affecting , which can contribute to the final fit of cemented All Ceram copings,

Trajtenberg et al (2008)[16] analysed the microleakage of all-ceramic Crowns using Self-etching Resin Luting Agents and concluded that Panavia F 2.0 resin luting agent and Rely X Unicem showed the least degree of microleakage at both the enamel and dentin margins.

Santos et al (2009)[17] investigated the surface treatment protocols for better marginal adaptation in Lithium disilicate reinforced ceramic and stated that the prepared tooth surface should be Sandblasted with 30- to 50-μm Aluminium oxide (Al_2O_3) particles (at 80 psi) followed by Etching with 9.5% hydrofluoric acid for 20 seconds prior to cementation for better marginal adaptation.

Dehailan (2009)[18] evaluated the Review of the Current Status of All-Ceramic Restorations and concluded that long-term survival was related to the fabrication method of all-ceramic restorations. And also stated that restorations fabricated using the hot pressing technique had the highest long-term survival. CAD/CAM ceramics had the next highest long-term survival.

Denry (2010)[19] reviewed the Ceramics for Dental Applications and concluded that as opposed to metal-ceramics, all-ceramics contain a significantly greater amount of crystalline phase, from about 35 volume % to about 99 volume %.

Komine et al (2010)[20] discussed the Current status of zirconia-based fixed restorations and described that Zirconium dioxide (zirconia) ceramics are currently used for fixed restorations as a framework material due to their better mechanical and optical properties.

Yuksel and Zaimoglu (2011)[21] assessed the Influence of marginal fit and cement types on microleakage of all-ceramic crown systems and concluded that marginal discrepancy and cement type had significant effects on microleakage.

Garcia et al (2011)[22] analysed the marginal adaptation and micro leakage between two zirconia oxide systems with the same cement and they concluded that Lava registered better marginal fit values than Zirkon Zahn but no significant difference in micro leakage.

Borges et al (2012)[23] evaluated the cervical fit of all ceramic crowns (IPS e-max Press, Cergo gold, and In Ceram) on bovine teeth with two luting agents before and after cementation and stated that all the three ceramic systems showed inferior cervical fits after cementation when compared to the cervical fit before cementation with the two cements.

Chen and Suh (2012)[24] examined the bonding of resin cements in different all ceramic systems and concluded that the resin bond to silica-based ceramics, like lithium disilicates show better marginal adaptation.

Tolga et al (2013)[25] compared the marginal adaptation of crowns fabricated with four different all-ceramic systems using an image analysis method. and stated that In-Ceram all-ceramic crowns showed the largest marginal gap, than Celay crowns and IPS Empress 2.

Ali and Sabea (2013)[26] investigated the marginal adaptation, internal fitness and micro leakage of Zolid, Zirconia and Empress 2 all ceramic crown materials and also evaluated the correlation of micro leakage of these ceramic crown materials to the marginal fitness and showed that Zolid had the best marginal adaptation, internal fitness and less micro leakage compared to the other two groups and also reported that the CAD/CAM ceramic was better than heat-pressed ceramic.

Amal (2013)[27] evaluated the marginal and internal discrepancies of different aesthetic restorations and stated that ceramics with a zirconium oxide framework have become the standard for indirect aesthetic restorative materials.

Ji et al (2013)[28] discussed the Zirconia bioceramics as All-ceramics crowns material and stated that Zirconia (ZrO_2), a well-known structural and biomedical ceramic, showed excellent biocompatibility, aesthetics and heat conductivities comparable to that of the metallic-based ones, which is feasible to prepare all ceramic crowns.

Chen (2013)[29] reviewed the Bonding of Resin Materials to All-Ceramics and concluded that the preferred protocol for Zirconia-resin bonding is the combination of surface roughness such as air-abrasion and treatment with a phosphate-containing Zirconia primer followed by cementation with non-phosphate-containing resin cement.

Ozyoney et al (2013)[30] evaluated and compared the shear bond strength of IPS Empress II and recent IPS e-max ceramics luted with eight different luting resins tested with three adhesion types: total etch, self-etch or self-adhesion and they concluded that glass lithium ceramics may be preferred to lute with a total-etch adhesive system in order to obtain the best bond strength from dental tissue.

Hilgert et al (2013)[31] compared the marginal adaptation of ceramic copings front of two finish lines and addition of ceramic and they concluded that the round shoulder finish lines presented better values of marginal gap than deep chamfer and the addition of ceramic influences in the final gap values of marginal adaptation.

Bodereau et al (2013)[32] investigated the Aesthetic All-ceramic Restorations and concluded that All-ceramic crowns are indicated in both anterior and posterior restoration and are contra-indicated in cases of para-functional habits.

Dhanraj and Sathyamurthy (2014)[33] evaluated the Effect of Marginal Discrepancy induced by CAD/CAM and Conventional Ceramic Processing Techniques in All Ceramic Complete Veneer Retainers and concluded that CAD/CAM restorations are becoming increasingly popular due to its several advantages over the conventional ceramic processing techniques.

Demir et al (2014)[34] analysed the marginal fit of full ceramic crowns by the microcomputed tomography technique and concluded that poor marginal adaptation of ceramic crowns can result in damage to the tooth, periodontal tissues and the restoration.

Daou and Gotmeh (2014)[35] compared three all ceramic systems and concluded that the Cercon and Lava systems use partially sintered Y-TZP–based blanks for milling the infrastructures, whereas the DC-Zirkon infrastructures are milled from fully sintered Y-TZP–based blanks by the DCS-Precident system which are superior.

Chagas et al (2014)[36] evaluated the marginal adaptation and traction resistance of zirconium crowns made up using two different techniques and cemented on pins with three types of cements (Zinc phosphate, Resin modified GIC and resin cement) and they concluded that Rely X luting 2 (RMGIC) cement obtained not only a lower marginal dis-adaptation but also a better efficiency on traction resistance among the three cements.

Jalalian et al (2014)[37] studied the Effect of Thickness of Zirconia Core on Marginal Adaptation of All-Ceramic Restorations and concluded that increasing the zirconia core thickness can decrease marginal gap in all-ceramic crowns.

Konings and Krueger (2015)[38] discussed the permanent luting cements and stated that except for the new self adhesive cements, the composite resin cements can be technique sensitive and require excellent fluid/moisture control.

Zubaidi et al (2015)[39] evaluated the effect of two gingival finishing lines (90° shoulder and deep chamfer) on the marginal fitness of two types of full anatomic all-ceramic crowns; zirconia crowns (Zikonzhan) and glass ceramic crowns (IPS e-max CAD) milled with CAD/CAM system and concluded that deep chamfer margin could be more preferable finishing line than 90° shoulder especially for zirconia full crowns.

Hamdy (2015)[40] investigated the marginal adaptation and fracture resistance of Zirconium Dioxide and Resin Nano Ceramic CAD-CAM restorations (Lava Ultimate Restorative, 3M ESPE) and concluded that Zirconium Dioxide restorations showed significantly higher marginal discrepancy than Resin Nano Ceramic, and fracture resistance of Zirconium Dioxide was significantly higher than Resin Nano Ceramic restorations.

Owittayakul et al (2015)[41] evaluated the microleakage of zirconia frameworks cemented with two types of phosphate monomer-based resin cements and stated that Zirconia is non silica based ceramic and thus cannot be etched with hydrofluoric acid and therefore, luting agents are important to improve the retention of zirconia ceramics.

Parimala et al (2015)[42] examined the marginal fit of metal ceramic and metal free ceramic crowns and concluded that the pressed ceramic copings have better initial marginal fit than that the metal copings.

Dessouky (2015)[43] compared the Marginal Adaptation versus Aesthetics for Various Dental Restorations and stated that Heat-Pressed Ceramics as reinforced cores combined the lost-wax technique with heat pressed technology has the advantage of reducing sintering shrinkage during ceramic firing and hence improving te marginal adaptation.

Bindo et al (2015)[44] evaluated the marginal adaptation of a fibre glass reinforced resin crown and concluded that the gaps were within the limits of clinical tolerance and considering the clinical difficulty in making the prosthetic piece, the treatment was shown to be satisfactory with regard to marginal adaptation.

Hemalatha and Ganapathy (2016)[45] investigated the marginal discrepancy in ceramic laminate veneers influenced by resin luting agents and concluded that marginal discrepancy is observed irrespective of the various processing techniques employed but it can be overcome by the use of resin luting agents.

Dixit et al (2016)[46] compared the Marginal Fit of CAD-CAM Zirconia, selective metal laser sintered (SMLS) cobalt chromium(Co-Cr), Pressable Lithium Disilicate, and concluded that, the marginal fit of CAD/CAM zirconia copings is more accurate as compared to selective metal laser sintered (SMLS), pressable Lithium disilicate and cast Nickel; Chromium(Ni-Cr) alloy copings on a standardized metal master model.

Breemer et al (2016)[47] studied the Cementation of Glass-Ceramic Posterior Restorations and concluded that adhesive systems (3-step, etch-and-rinse) show the best (micro)shear bond strength values compared to self-adhesive and self-etch systems when luting to human dentin.

Jalalian et al (2016)[48] assessed and compared the fracture strength of 0.4 mm and 0.7 mm core thicknesses and concluded that both 0.4 and 0.7 mm lithium disilicate glass ceramic core thicknesses were able to withstand maximum forces during mastication.

Saraswathi et al (2016)[49] discussed the properties of monolithic crowns and layered zirconia crowns and concluded that full zirconia monolithic crowns meet the requirements of good strength; good wear resistance, good marginal seal and good aesthetics thereby meeting the functional demands in posterior teeth.

MATERIALS AND METHODOLOGY

In the present study an effort was made to find out the marginal adaptation and microleakage, luted with resin cement of the three groups.

MATERIALS:

1) Natural maxillary 1st premolar.

2) Tooth preparation burs (MANI, INDIA).

3) Addition silicone putty impression material (AQUASIL, GERMANY).

4) Dental wax (HINDHUSTAN, INDIA).

5) Cobalt – Chromium Pellet.

6) Heat cure acrylic material (DPI, INDIA).

7) Self – adhesive resin luting cement (RELY X U 200, GERMANY).

8) Thirty All ceramic crowns.

9) Diamond wheel disc (edenta, Swiss made)

10) 0.1% Methylene blue solution.

11) Distilled water.

12) Investment material.

EQUIPMENTS:

1) Airotor hand piece (NSK, JAPAN).

2) Casting machine (BEGO FORNAX MODEL 26300, GERMANY).

3) Milling unit (LAVA CNC500, GERMANY).

4) Tooth cutting lathe (RAY FOSTER, USA).

5) Scanning electron microscope.

6) Composite Light Curing Unit (BEE COOL, GERMANY).

SAMPLES:

In the present study, 30 all ceramic crowns were used as samples (10 LAVA zirconia, 10 DENTCARE zirconia and 10 IPS E- max) total of 30 All ceramic crowns were divided into 3 groups.

- **Group I**, consists of 10 IPS e – max system (pressable glass ceramics).

- **Group II** consists of 10 LAVA zirconium crowns (Germany).

- **Group III** consists of 10 DENTCARE zirconium crowns.

METHODOLOGY:

Methodology of this study is been divided into five stages:

1. Sample selection.
2. Sample preparation.
3. Sample grouping and crowns fabrication.
4. Crown luting and curing.
5. Sample sectioning.
6. Measurements.

SAMPLE SELECTION:

In the present study freshly extracted human maxillary first premolars were selected (orthodontic purposes). The crown size of 8 mm (mesio-distally) were selected which are free from carious and restoration.

SAMPLES PREPARATION:

The selected tooth was prepared for all ceramic crowns with ideal dimension. The preparation depths were 1mm axially and 2mm occlusally. The shoulder finish line margins were supra-gingival and the tooth preparation had a convergence angle of six degrees.

Using addition silicone putty(AQUASIL) an impression of prepared maxillary first premolar was made and wax tooth model was fabricated from the impression.

The wax tooth model was invested and casted to fabricate cobalt – chromium metal tooth model. The cobalt – chromium tooth model is duplicated using additional silicone to fabricate 30 heat cure acrylic models.

SAMPLES GROUPING AND CROWN FABRICATION

The samples were divided into three groups. Each group consist of ten all ceramic crowns. All ceramic crowns had been fabricated in DENTCARE dental lab (Kerala, India).

Group 1: Received a pressable glass ceramic crowns

(IPS e – max, ivoclar vivadent, Germany)

Group 2: Received a CAD-CAM LAVA zirconium crowns

(3M ESPE, Germany)

Group 3: Received a CAD-CAM DENTCARE Zirconium crowns.

CROWNS LUTING AND CURING

A dual cure resin luting agent (Rely X U200 Self-Adhesive resin,3M, Germany) was used to cement the ceramic crowns to each model, an equal length of the luting resin is dispensed with the special auto dispense property of the resin tube on the mixing pad, was done according to the manufacturer instructions, the mixed cement was painted on the internal surfaces of the crowns.

Crowns were luted on the prepared tooth model with finger pressure for 10 minutes. Buccal, lingual, mesial and distal tooth-crown margins were photo polymerized (Dental light cure unit), at 1 mm distance for 40 seconds each with a light intensity of 400 MW(megawatts)/ $cm^{2,}$ and the excess cements from the margins are removed.

After 24 hours of storage in distilled water at 37 °C, all teeth were subjected to 500 thermal cycles between 5 ° and 55 °C using a dwell time of 30 seconds.

All the samples were placed in a flat container in upside down position and 0.1%methylene blue dye was poured such that the finish line of all samples is covered. All samples were immersed for 24 hours.

SAMPLE SECTIONING:

Sagittal cross section of the sample has been made using a Diamond wheel disc, having a disc thickness of 0.01mm cutting at high speed using a Tooth cutting lathe (RAY FOSTER, USA) for all the 30 samples.

MEASUREMENT:

Marginal adaptation: Values were recorded under a Scanning electron microscope 400X magnification. Marginal gap had been considered as the perpendicular measurement from the margin of the crown to the margin of the preparation. Hyper extended and hypo extended margins were excluded and the micrometre was used as unit of length.

Micro-leakage: The presence of microleakage was confirmed by the visualization of a blue colored reaction at the tooth-cement interface. Microleakage patterns were fully registered on the buccal and lingual margins as well as mesial and distal margins with the stereomicroscope 4X magnification.

Microleakage is scored using Tjan's etal.

Method:

0=no microleakage

1=microleakage to one-third of axial wall

2=microleakage to two thirds of axial wall

3=microleakage along the full length of axial wall

4=microleakage over the occlusal surface.

STATISTICAL ANALYSIS:

The result data were statistically analyzed. Analysis was carried out with one way analysis of variance (ANOVA) followed by Post Hoc and Dunnet 't' test to find statistical significance between and within the groups.

FIGURES

Fig 1: PREPARED NATURAL 1st PREMOLAR (OCCULUSAL VIEW)

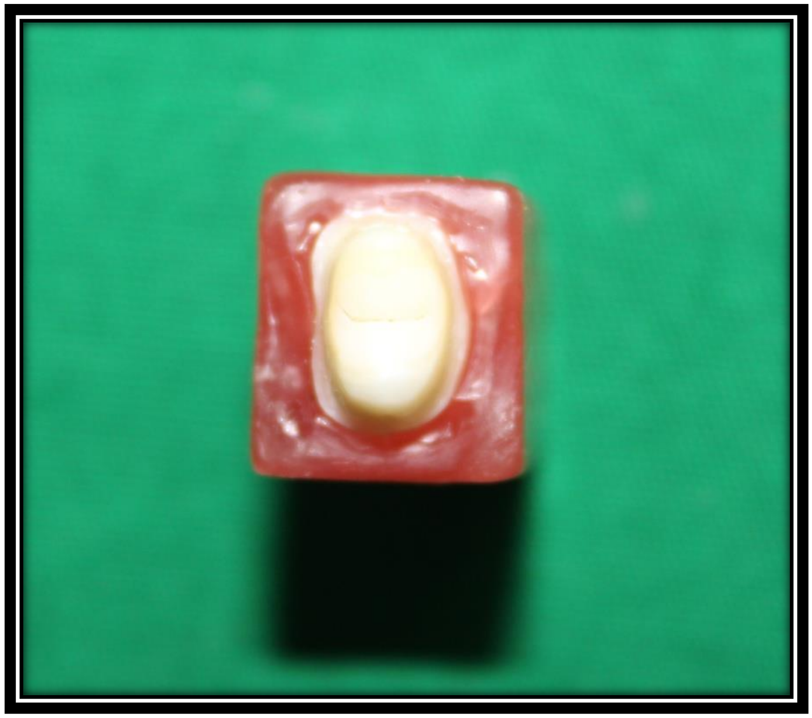


Fig 2: PREPARED NATURAL 1st PREMOLAR (LATERAL VIEW)

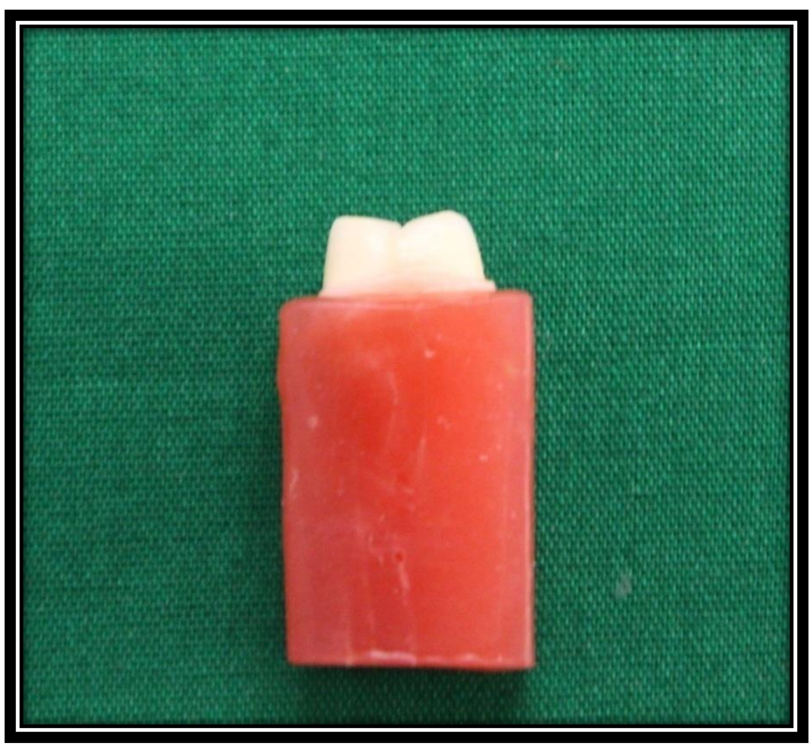


Fig 3: COBALT-CHORIMIUM TOOTH MODEL (OCCLUSAL VIEW)

Fig 4: COBALT-CHORIMIUM TOOTH MODEL (LATERAL VIEW)

Fig 5: HEAT CURE ACRYLIC TOOTH MODELS (30 No's)

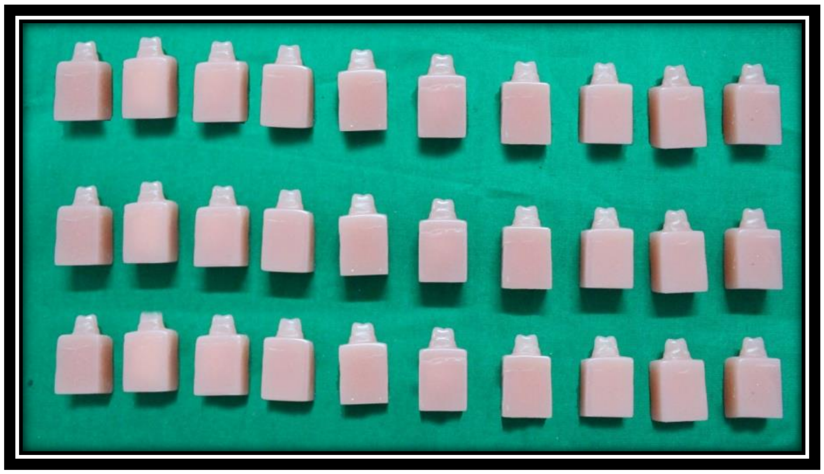


Fig 6: ALL CERAMIC CROWNS (30 No's)

Fig 7: SELF ADHESIVE RESIN LUTING CEMENT

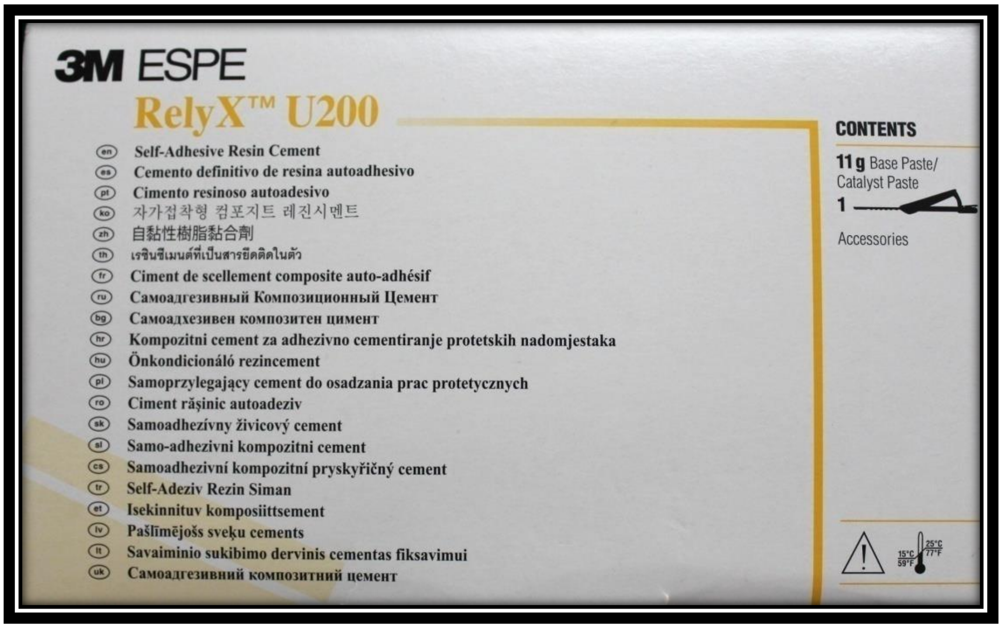


Fig 8: BASE PASTE AND CATALYST PASTE

Fig 9: COMPOSITE LIGHT CURE

Fig 10:CURING OF LUTED ALL CERAMIC CROWN

Fig 11: DISTILLED WATER

s

Fig 12:SAMPLES IMMERSED IN DISTILLED WATER

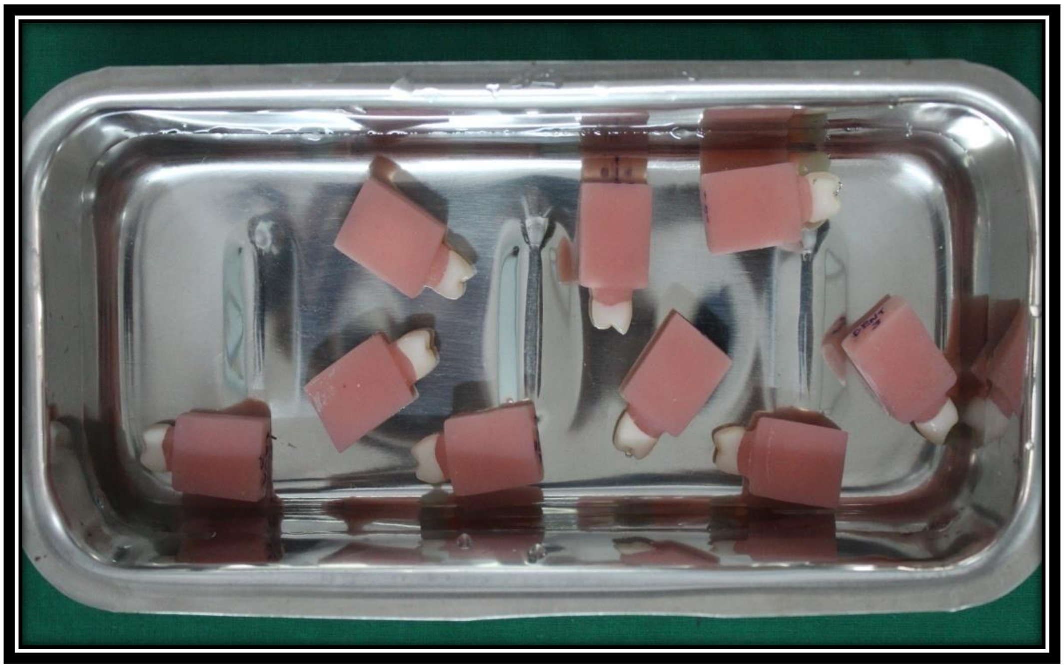


Fig 13:METHYLENE BLUE SOLUTION 0.1%

Fig 14: SAMPLES IMMERSED IN 0.1% METHYLENE BLUE SOLUTION

Fig 15:DIAMOND WHEEL DISRS

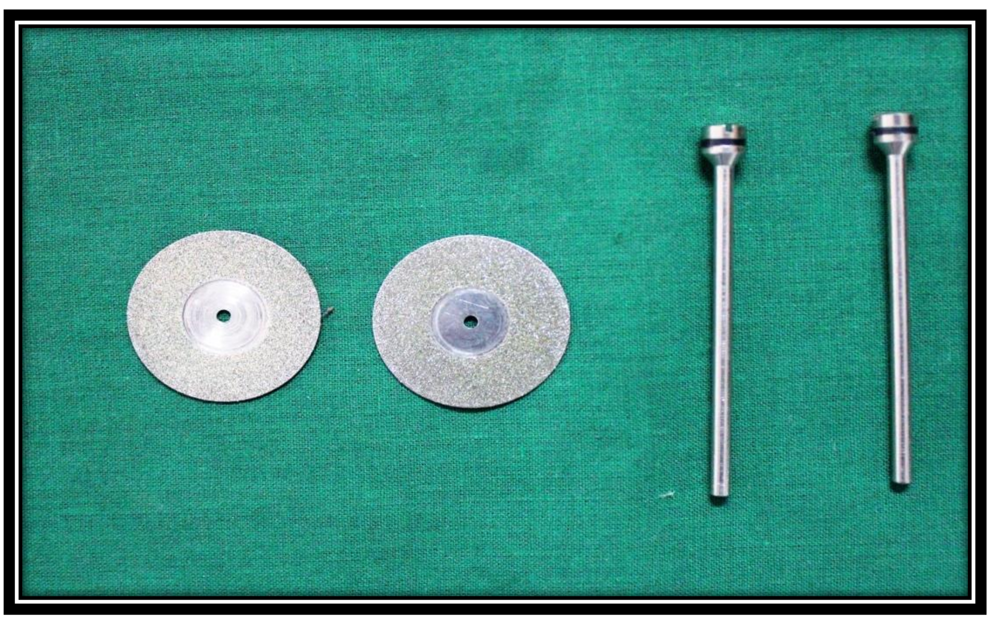


Fig 16:SECTIONING OF SAMPLES

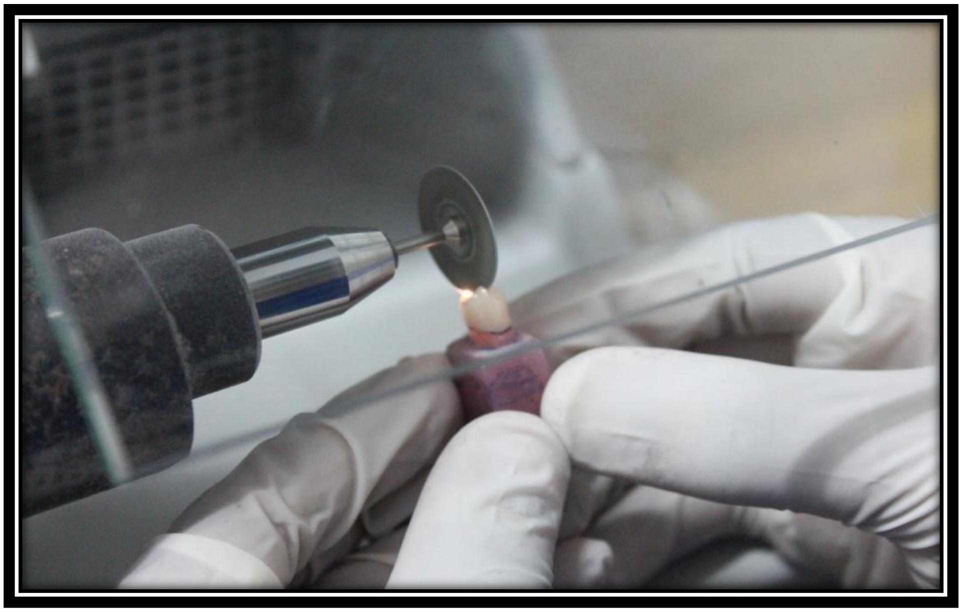


Fig 17:PREPARED SAMPLE

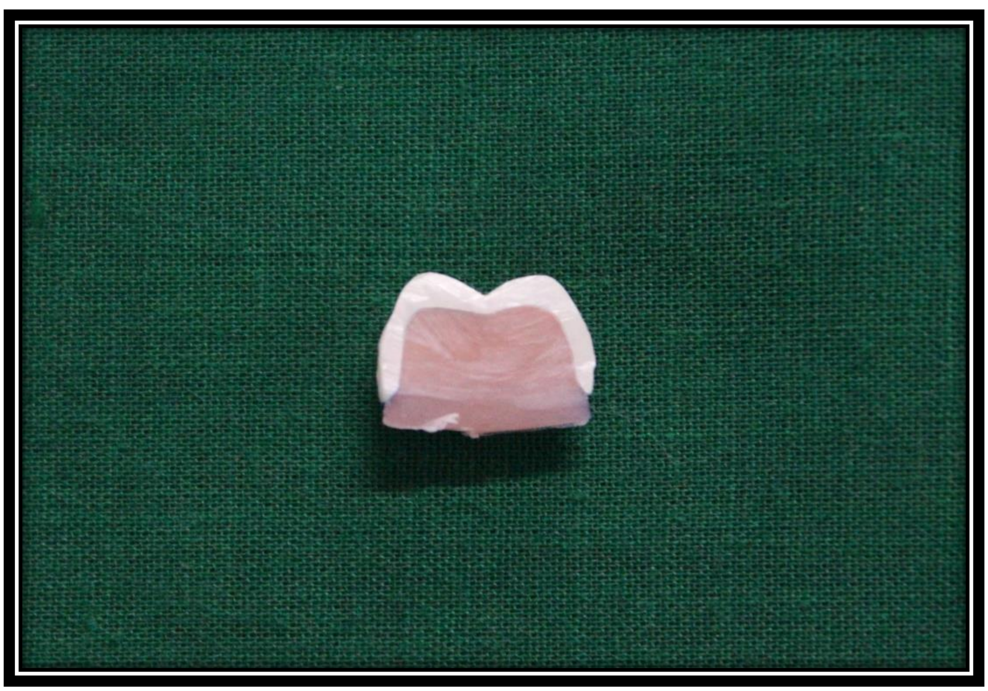


Fig 18:SAMPLE CONTAINER

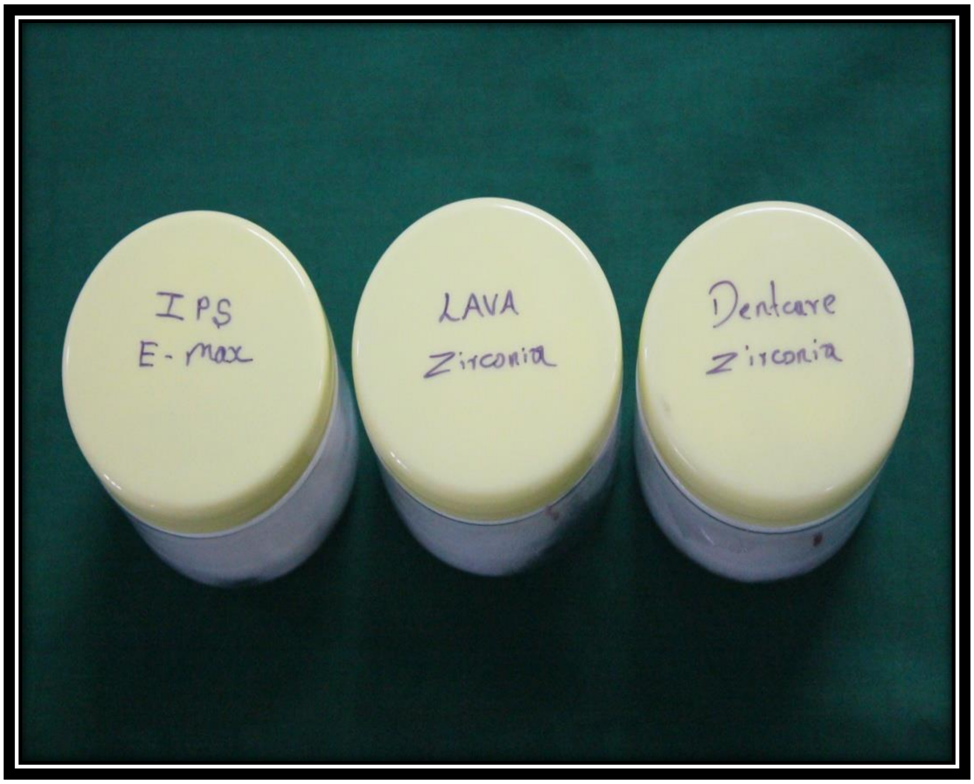


Fig 19: SCANNING ELECTRON MICROSCOPE

Fig 20:STEREOMICROSCOPE

Fig21:AIROTOR

Fig 22: CASTING MACHINE

RESULTS AND OBSERVATIONS

Statistical analysis:

The data was analyzed by Statistical Package for Social Sciences (SPSS 16.0) version. One way ANOVA (Posthoc) followed by Dunnet **'**t**'** test applied to find the statistical significant between the groups. P value less than 0.05 considered statically significant at 95% confidence interval.

Table I: Total number of samples in each group.

Table II**:** Comparison of marginal adaptation and microleakage in group I.

Table III:Comparison of marginal adaptation and microleakage in group II.

Table IV: Comparison of marginal adaptation and microleakage in group III.

Table V: Mean Marginal adaptation and micro leakage values of group I, group II and group III .

Table VI: Comparison of Marginal adaptation values of group-I with other groups.

Table-VII: Comparison of Marginal adaptation values of group-II with group I and group III .

Table-VIII: Comparison of Marginal adaptation values of group-III with

TABLE I:

TOTAL NUMBER OF SAMPLES IN EACH GROUP

GROUPI	10 IPS e-max(Pressable glass ceramic).
GROUP II	10 LAVA zirconia crowns.
GROUPIII	10 DENTCARE zirconia crowns.

TABLE II:

COMPARISON OF MARGINAL ADAPTATION AND MICROLEAKAGE IN GROUP I

SL.No	Marginal adaption (µm)	Microleakage(Grade)
1	197.45	2
2	198.67	2
3	196.70	2
4	197.34	2
5	197.45	3
6	198.12	2
7	197.34	2
8	198.34	2
9	197.13	2
10	197.40	2

TABLE III:

COMPARISON OF MARGINAL ADAPTATION AND MICROLEAKAGE IN GROUP II

S. No	Marginal adaption(µm)	Micro leakage(Grade)
1	287.45	3
2	289.56	3
3	285.90	3
4	287.90	3
5	287.01	3
6	288.09	3
7	286.90	3
8	287.91	3
9	287.03	3
10	287.45	4

TABLE IV:

COMPARISON OF MARGINAL ADAPTATION AND MICROLEAKAGE IN GROUP III

S. No	Marginal adaption (µm)	Microleakage(Grade)
1	397.89	4
2	396.09	4
3	397.67	4
4	398.03	4
5	397.45	4
6	397.56	4
7	397.10	4
8	398.90	4
9	396.98	4
10	397.91	4

TABLE-V:

MEAN MARGINAL ADAPTATION AND MICRO LEAKAGE VALUES OF DIFFERENT GROUPS

Groups	Marginal adaptation(μm) (MEAN±SD)	Micro leakage(Grade) (MEAN±SD)
Group-I	197.59±0.59	2.10±0.31
Group-II	287.52±0.96	3.10±0.32
Group-III	397.56±0.74	4.00±0.00

TABLE-VI:

COMPARISON OF MARGINAL ADAPTATION VALUES OF GROUP-I WITH OTHER GROUPS

Groups	Marginal adaptation(μm) (MEAN±SD)	P value
Group-I	197.59±0.59	
Group-II	287.52±0.96*	0.001
Group-III	397.56±0.74*	0.001

(*p<0.05 significant compared Group-I with other groups)

TABLE-VII:

COMPARISON OF MARGINAL ADAPTATION VALUES OF GROUP-II WITH OTHER GROUPS

Groups	Marginal adaptation(μm) (MEAN±SD)	P value
Group-II	287.52±0.96	
Group-I	197.59±0.59*	0.001
Group-III	397.56±0.74*	0.001

(*p<0.05 significant compared Group-II with other groups)

TABLE-VIII:

COMPARISON OF MARGINAL ADAPTATION VALUES OF GROUP-III WITH OTHER GROUPS

Groups	Marginal adaptation(μm) (MEAN±SD)	P value
Group-III	397.56±0.74	
Group-I	197.59±0.59*	0.001
Group-II	287.52±0.96*	0.001

(*p<0.05 significant compared Group-III with other groups)

TABLE-IX:

MULTIPLE COMPARISON OF MARGINAL ADAPTATION VALUES BETWEEN THE GROUPS

Groups	Marginal adaptation (μm) (MEAN±SD)	Comparison	P value
Group-I	197.59±0.59	I with II, III	0.001
Group-II	287.52±0.96*	II with I, III	0.001
Group-III	397.56±0.74*,#	III with I, II	0.001

(*p<0.05 significant compared Group-I with other groups,

#p<0.05 significant compared Group-II with other groups)

TABLE-X:

COMPARISON OF MICRO LEAKAGE VALUES OF GROUP-I WITH OTHER GROUPS

Groups	Micro leakage(Grade) (MEAN±SD)	P value
Group-I	2.10±0.31	
Group-II	3.10±0.32*	0.03
Group-III	4.00±0.00*	0.03

(*p<0.05 significant compared Group-I with other groups)

TABLE-XI:

COMPARISON OF MICRO LEAKAGE VALUES OF GROUP-II WITH OTHER GROUPS

Groups	Micro leakage(Grade) (MEAN±SD)	P value
Group-II	3.10±0.32	
Group-I	2.10±0.31*	0.03
Group-III	4.00±0.00*	0.03

(*p<0.05 significant compared Group-II with other groups)

TABLE-XII:

COMPARISON OF MICRO LEAKAGE VALUES OF GROUP-III WITH OTHER GROUPS

Groups	Micro leakage(Grade) (MEAN±SD)	P value
Group-III	4.00±0.00	
Group-I	2.10±0.31*	0.03
Group-II	3.10±0.32*	0.03

(*p<0.05 significant compared Group-III with other groups)

TABLE-XIII:

MULTIPLE COMPARISON OF MICRO LEAKAGE VALUES BETWEEN THE GROUPS

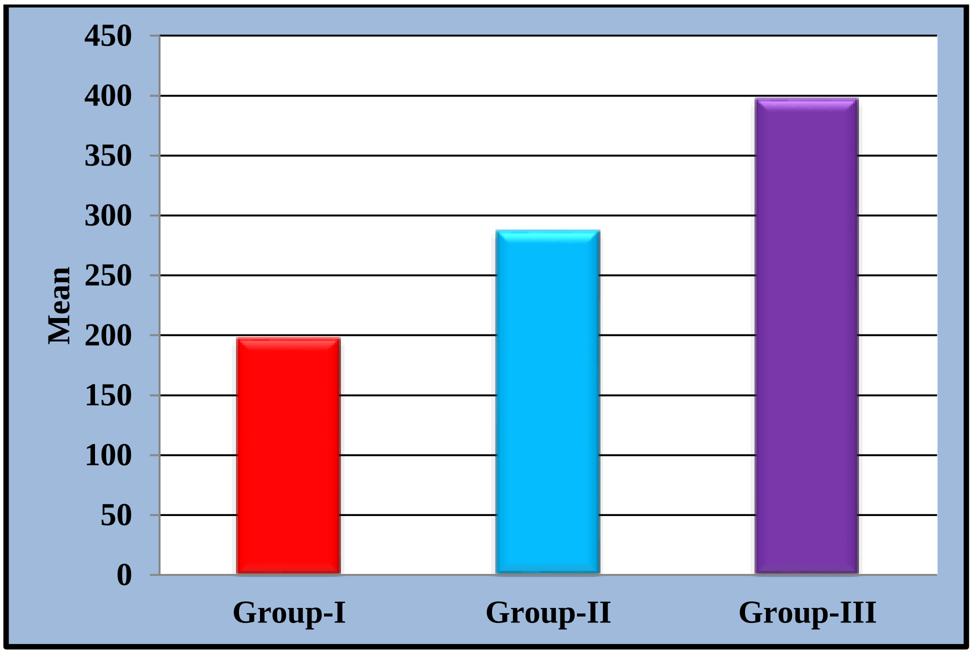
Groups	Micro leakage(Grade) (MEAN±SD)	Comparison	P value
Group-I	2.10±0.31	I with II, III	0.03
Group-II	3.10±0.32*	II with I, III	0.03
Group-III	4.00±0.00*,#	III with I, II	0.03

(*p<0.05 significant compared Group-I with other groups)

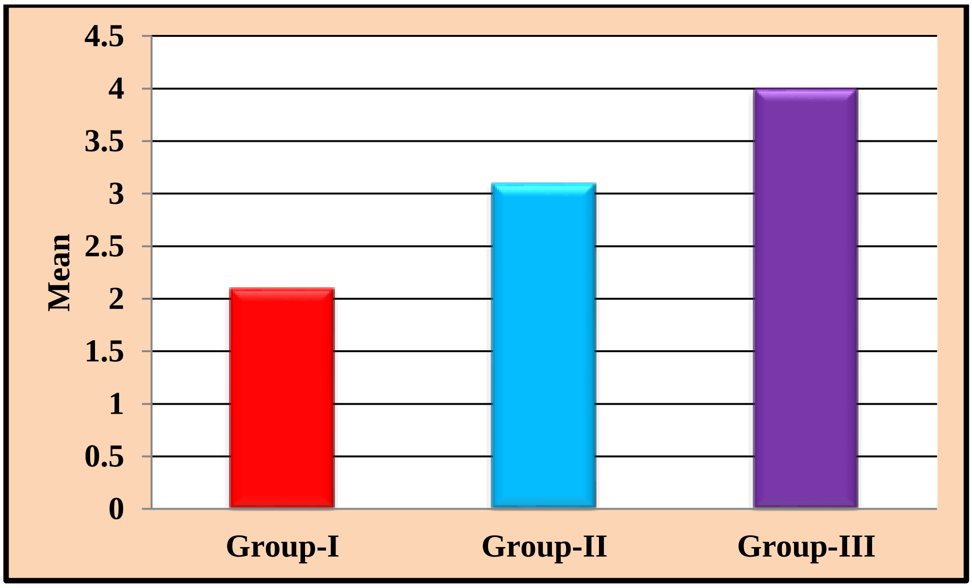
#p<0.05 significant compared Group-II with other groups)

GRAPHS

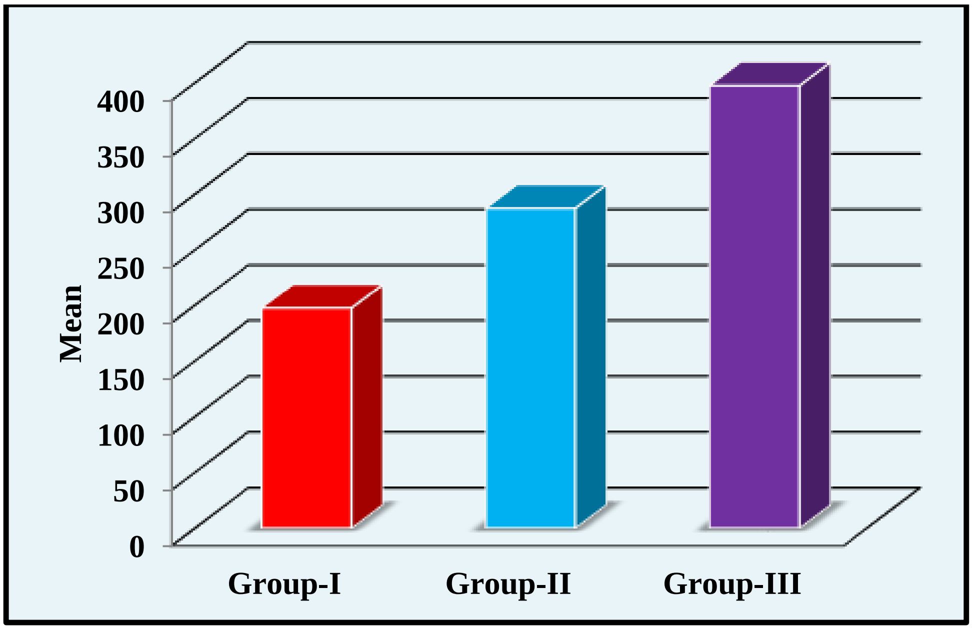
Graph-1:Mean Marginal adaptation(µm) values of different groups



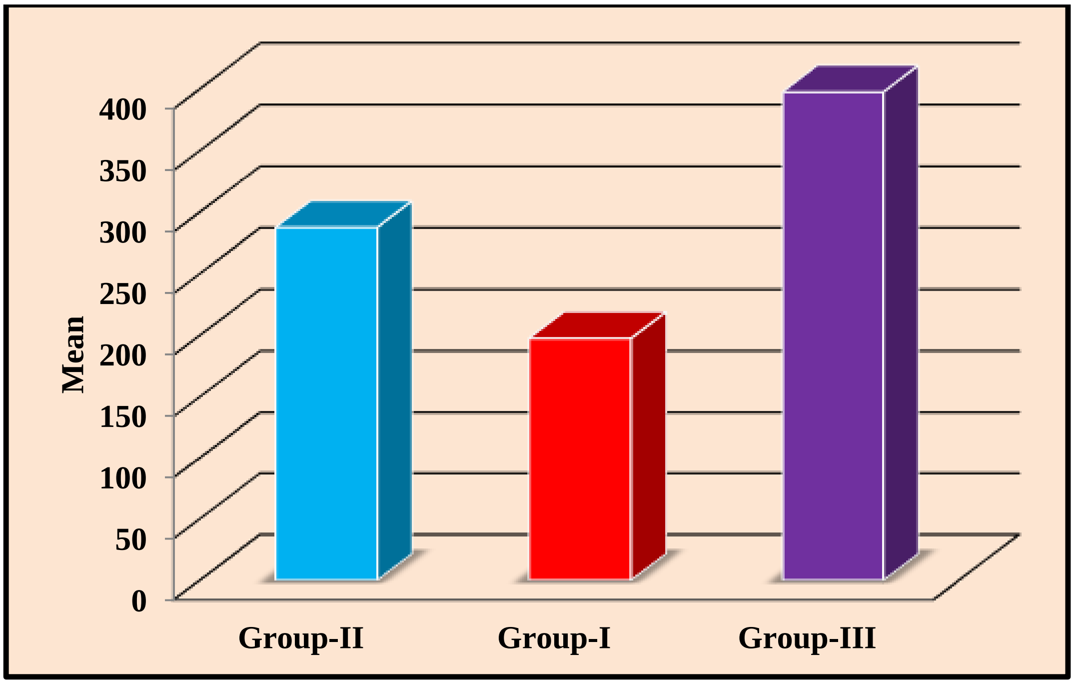
Graph-2: Mean Micro leakage(Grade) values of different groups



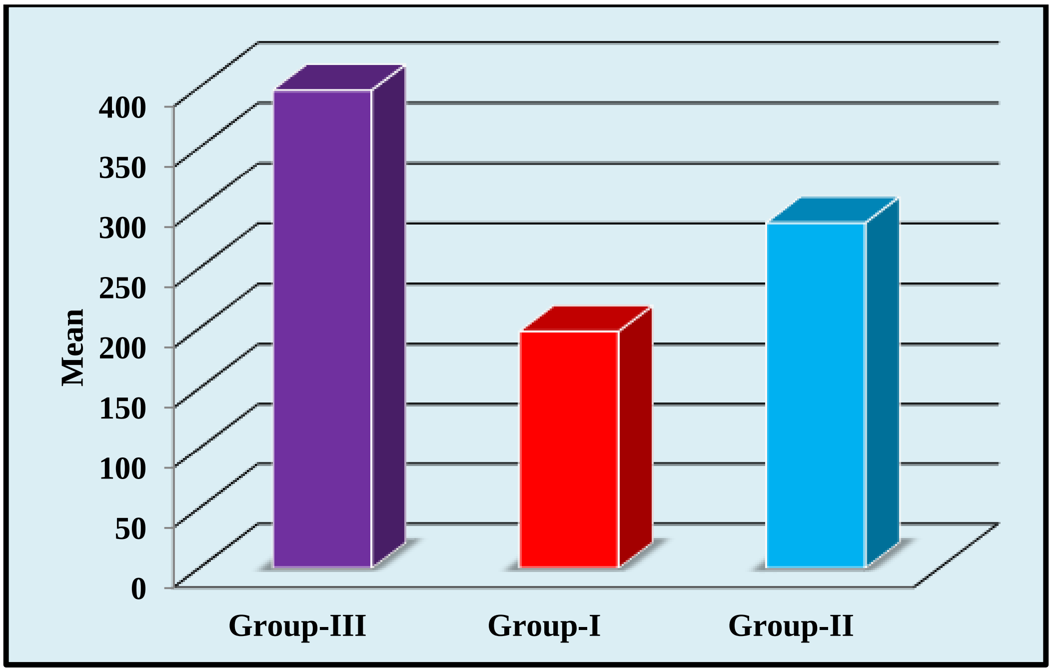
Graph-3: Comparison of Marginal adaptation(µm) values of Group-I with other groups



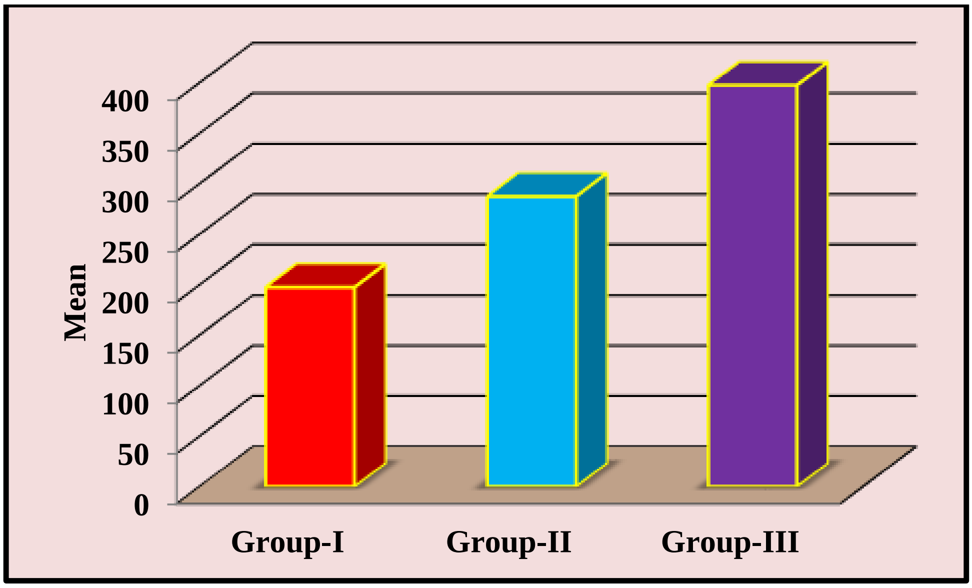
Graph-4: Comparison of Marginal adaptation(µm) values of Group-II with other groups



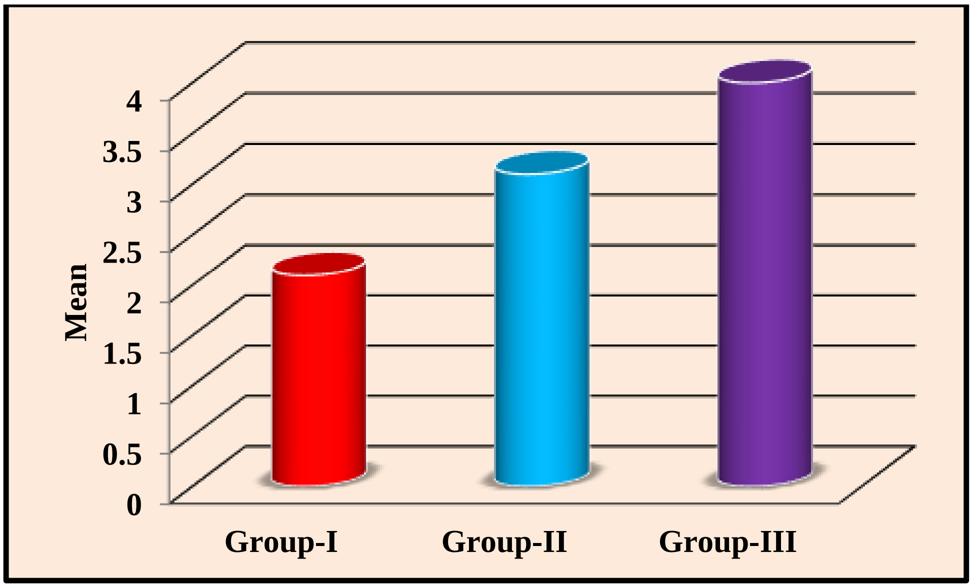
Graph-5: Comparison of Marginal adaptation(µm) values of Group-III with other groups



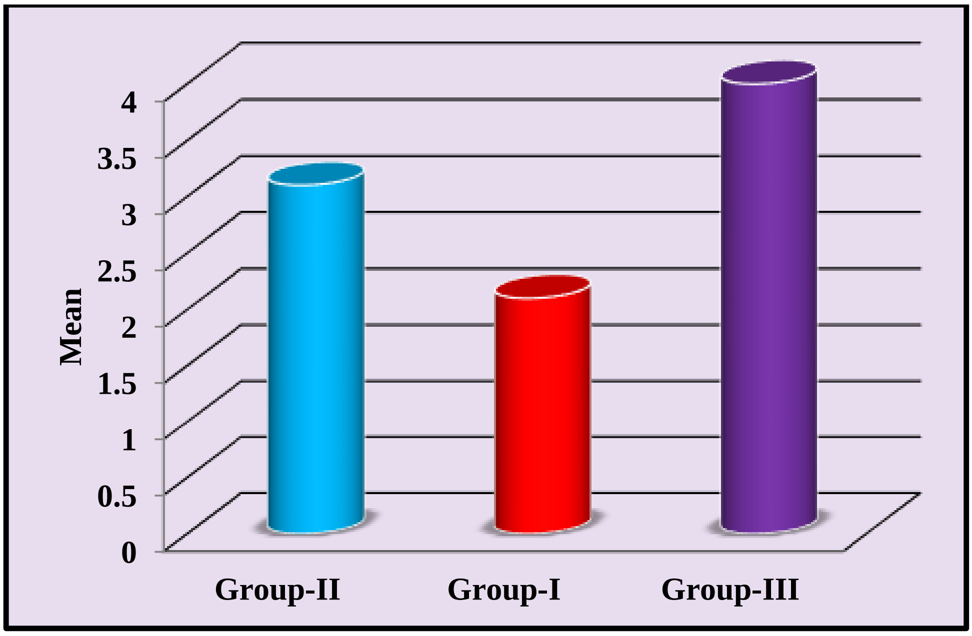
Graph-6: Multiple comparison of Marginal adaptation(µm) values between the groups



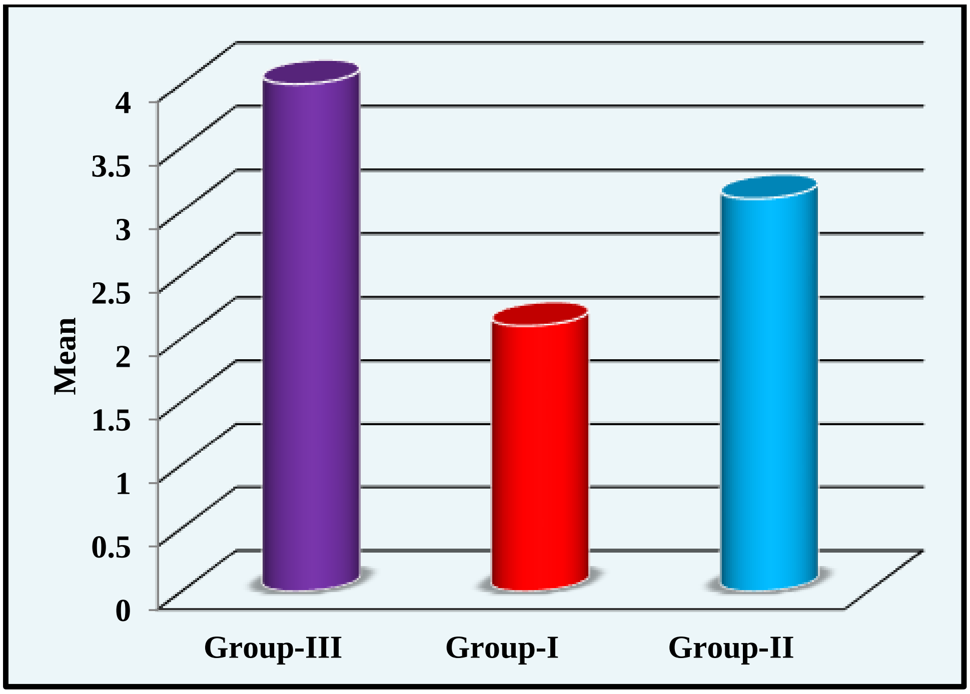
Graph-7:Comparison of Micro leakage(Grade) values of Group-I with other groups



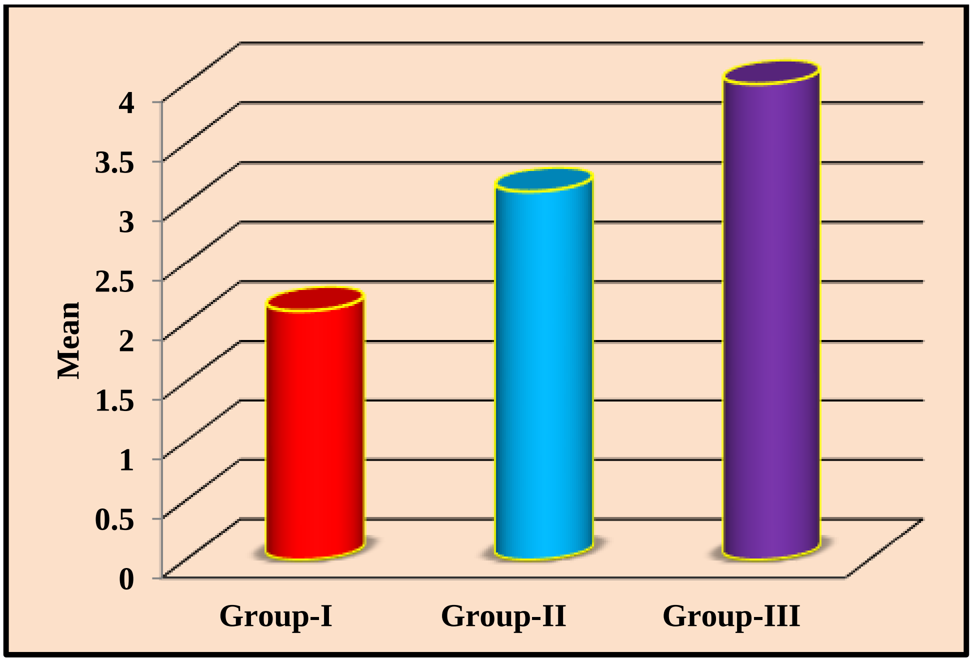
Graph-8: Comparison of Micro leakage(Grade) values of Group-II with other groups



Graph-9: Comparison of Micro leakage(Grade) values of Group-III with other groups



Graph-10: Multiple comparison of Micro leakage(Grade) values between the groups



SCANNING ELECTRON MICROSCOPIC ANALYSIS

SCANNING ELECTRON MICROSCOPIC ANALYSIS TO DETERMINE THE MARGINAL GAP

- Figure 23 represents the scanning electron microscopic image of group I under the magnification of 400X showed minimal buccal marginal gap than group II and group III.
- Figure 24 represents the scanning electron microscopic image of group I under the magnification of 400X showed minimal palatal marginal gap than group II and group III.
- Figure 25represents the scanning electron microscopic image of group II under the magnification of 400X showed more buccal marginal gap than group I and less marginal gap than group III.
- Figure 26 represents the scanning electron microscopic image of group III under the magnification of 400X showed more palatal marginal gap than group I and group II.
- Figure 27 represents the scanning electron microscopic image of group III under the magnification of 400X showed more buccal marginal gap than group I and group II.

FIG 23: SCANNING ELECTRON MICROSCOPE IMAGE SHOWING BUCCAL MARGINAL GAP OF GROUP I IPS E-MAX PRESSABLE CERAMIC CROWN

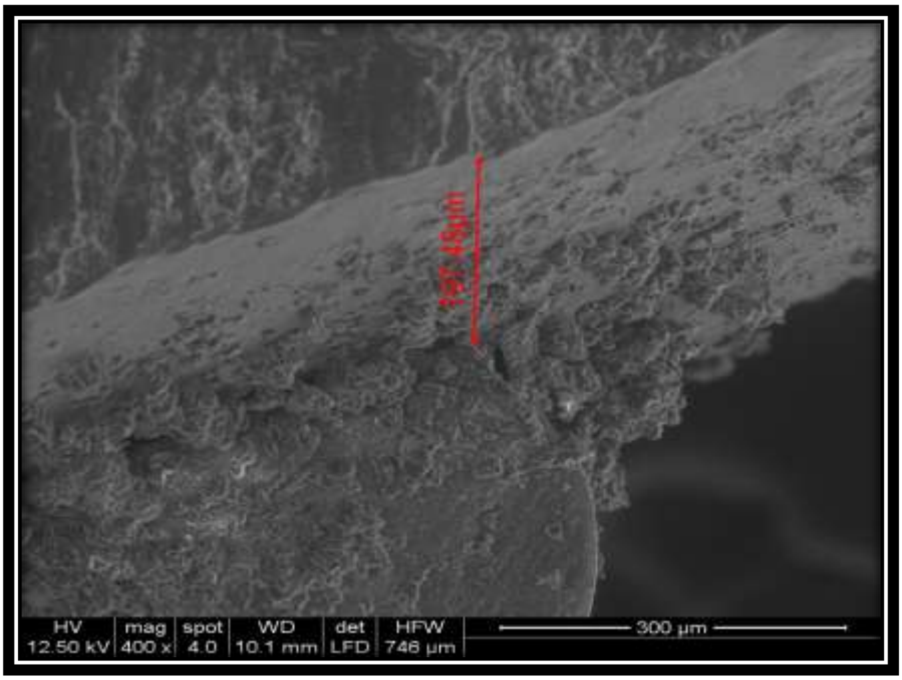


Fig 24: SCANNING ELECTRON MICROSCOPE IMAGE SHOWING PALATAL MARGINAL GAP OF GROUP I IPS E-MAX PRESSABLE CERAMIC CROWN

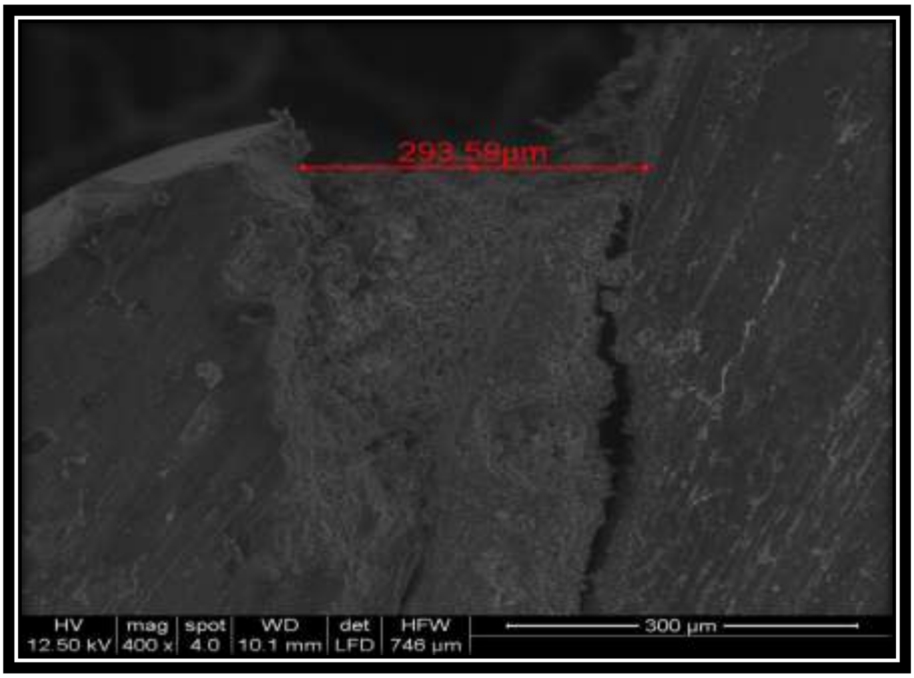


Fig 25: SCANNING ELECTRON MICROSCOPE IMAGE SHOWING BUCCAL MARGINAL GAP OF GROUP II LAVA ZIRCONIA CROWN

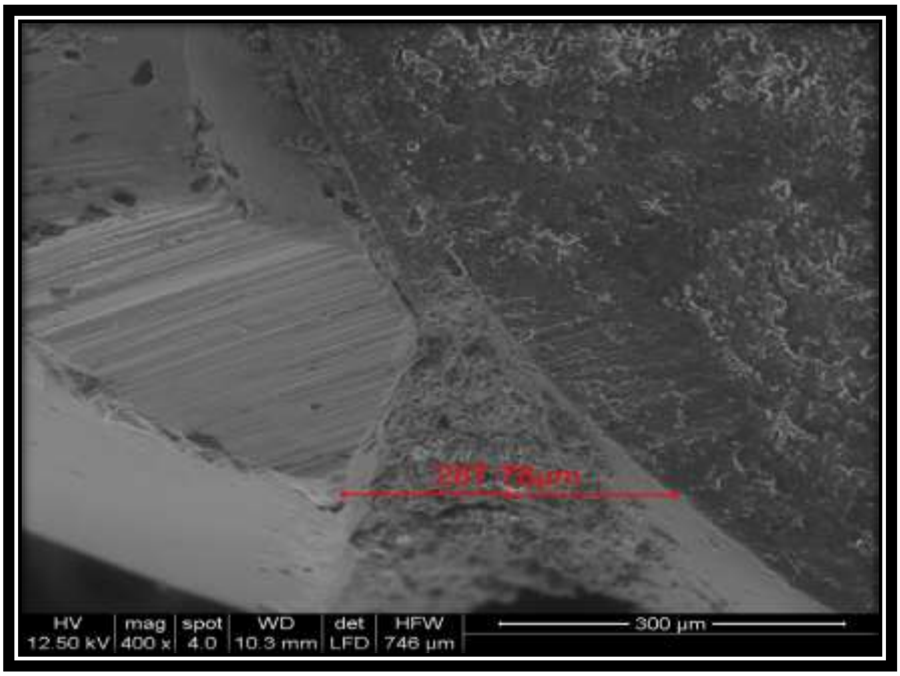


Fig 26: SCANNING ELECTRON MICROSCOPE IMAGE SHOWING BUCCAL MARGINAL GAP OF GROUPIII DENTCARE ZIRCONIA CROWN

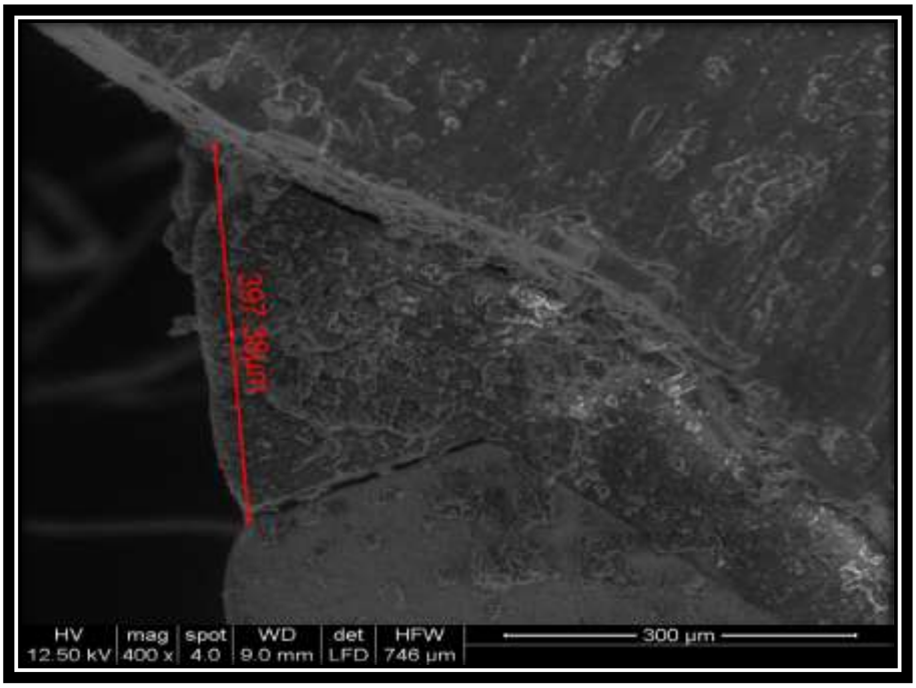
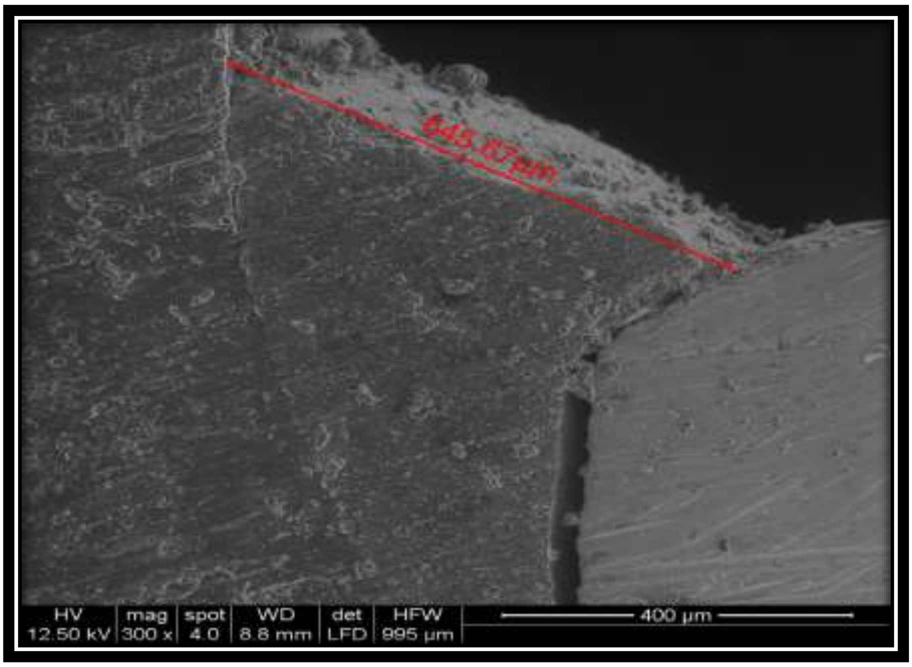


Fig 27: SCANNING ELECTRON MICROSCOPE IMAGE SHOWING PALATAL MARGINAL GAP OF GROUP III DENTCARE ZIRCONIA CROWN



STEREOMICROSCOPIC ANALYSIS

STEREOMICROSCOPIC ANALYSIS TO DETERMINE MICROLEAKAGE

- Figure 28 represents the stereomicroscopic image of group I under the magnification of 4x showed least penetration of die solution than group II and group III in cervical region.

- Figure 29 represents the stereomicroscopic image of group I under the magnification of 4x showed practically no penetration of die solution than group II and group III in occlusal region.

- Figure 30 represents the stereomicroscopic image of group II under the magnification of 4xshowed least penetration of die solution than group III and more penetration than group I in cervical region.

- Figure 31 represents the stereomicroscopic image of group II under the magnification of 4x showed more penetration of die solution through axial wall, but not to the occlusal.

- Figure 32 represents the stereomicroscopic image of group III under the magnification of 4x, showed more penetration of die solution than group I and II in cervical and axial region.

- Figure 33 represents the stereomicroscopic image of group III under the magnification of 4x, showed more penetration of die solution than group I and II in occlusal region.

Fig 28: STEREOMICROSCOPE IMAGE SHOWING CERVICAL MICROLEAKAGE OF GROUP CROWN I IPS E-MAX PRESSABLE GLASS CERAMIC CROWN

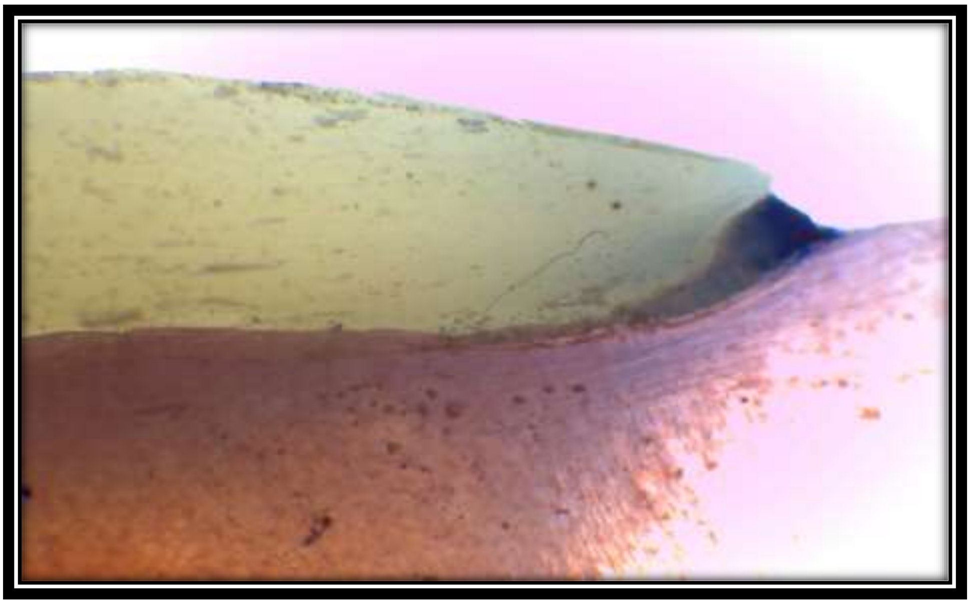


Fig 29: STEREOMICROSCOPE IMAGE SHOWING OCCLUSAL MICROLEAKAGE OF GROUP CROWN I IPS E-MAX PRESSABLE GLASS CERAMIC CROWN

Fig 30: STEREOMICROSCOPE IMAGE SHOWING CERVICAL MICROLEAKAGE OF GROUP II LAVA ZIRCONIA CROWN

Fig 31: STEREOMICROSCOPE IMAGE SHOWING OCCLUSAL MICROLEAKAGE OF GROUP II LAVA ZIRCONIA CROWN

Fig 32: STEREOMICROSCOPE IMAGE SHOWING CERVICAL MICROLEAKAGE OF GROUP III DENTCARE ZIRCONIA CROWN

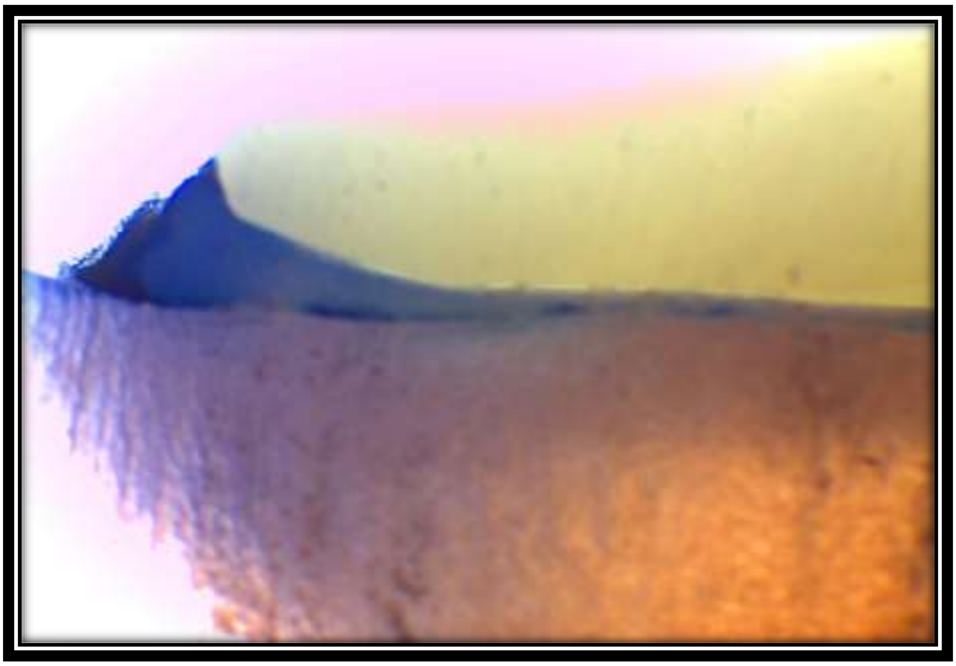


Fig 33: STEREOMICROSCOPE IMAGE SHOWING OCCLUSAL MICROLEAKAGE OF GROUP III DENTCARE ZIRCONIA CROWN

DISCUSSIONS

Dental alloys were used in the past for restorations in the oral cavity. The paradigm shift to All ceramic restorations is due to the increased demand for aesthetics. Also, All ceramic restorations are more biocompatible than metal alloys.

Many alternatives have been suggested for restoring lost tooth structure in the posterior region. In the 20th century, Porcelain-fused-to-metal (PFM) restorations have accounted for a significant proportion of posterior tooth restorations. The patient and clinician alike have an interest in aesthetic restorations that are not limited to just the anterior teeth. Apart from poor aesthetics, metal-based crowns have some other disadvantages such as galvanic and corrosive side effects as well as causing gingival discoloration[5]. As a result, posterior tooth-colored adhesive restorative techniques have grown considerably over the last decade. All-ceramic crowns were routinely placed not only in the anterior aesthetic zone but also in the posterior where they were subjected to greater occlusal forces and stress from cyclic loading[50].

As the demand for more natural-looking crowns has increased, dentists and porcelain manufacturers have investigated a number of methods to help reinforce ceramics with the goal of fabricating an All-ceramic restoration that delivers excellent aesthetics and good biocompatibility. In addition, these restorations need to have sufficient strength to allow its use anywhere in the mouth[51].

The introduction of CAD/CAM systems for the production of machined inlays, onlays, veneers, and crown led to development of a new generation of ceramics that are machinable. Direct bonding of ceramic crowns, veneers and inlays to conservative tooth preparations using low-viscosity resin cements is now a common practice.

The purpose of the present study was to investigate the marginal adaptation and microleakage of different types CAD/CAM zirconia crowns with that of pressable glass ceramics. The importance of conserving tooth tissue is unquestionable and has been stated by many researchers up till now. The principles of minimal invasive dentistry are getting more widely spread among clinicians and more people are willing to apply them in practice.

However, while there may be an impetuous to apply minimal preparation designs, it is not clear what constrains may be imposed on tooth design by the material used and the method of fabrication. If materials and design are inappropriate, then this can increase the probability of restoration failure[9].

The success of a restoration is determined by various factors, among which is the marginal fit of the restoration. Lack of adequate fit is potentially detrimental to both the tooth and the supporting periodontal tissues, due to cement solubility or plaque retention. However, the definitions of marginal fit vary considerably among investigators and often the same term is used to refer to different measurements, or different terms are used to refer to the same measurements[5].

In this study IPS e-max materials (group I) showed the lowest mean marginal adaptation value **(197.59±0.59µm)** whereas LAVA materials (group II) and DENTCARE materials (group III) showed mean marginal value of **(287.52±0.96µm)** and **(397.56±0.74µm)** respectively.

When these results were analyzed, the lowest marginal gap observed for IPS e-max system (group I) may be due to the pressable ceramic that is subjected to a less firing cycles than that for LAVA (group II) and DENTCARE (group III) which is double layered computer-aided design/computer-aided manufacturing material system. Whereas IPS e-max which is a heat-pressed ceramic material system and moreover less firing procedure inherent on that with less distortion. Hence IPS e-max gives less marginal gap after the fabrication process.

When the results were subjected to statistical analysis the LAVA (group II) showed less marginal gap when compared to DENTCARE (group III).The above findings showed that value obtained for marginal gap is least for IPS e-max and highest for DENTCARE zirconia.

The results showed IPS e-max system should be indicated were the occlusal load can be compromised. In case of posteriors if zirconia restoration is indicated better to select LAVA system than DENTCARE system. This is because marginal gap for LAVA system is less compared to DENTCARE system.

Other possible causes are that LAVA and DENTCARE usually require more laboratory steps for fabrication and processing which might increase the possibility for errors and distortion. IPS e-max requires fewer steps for fabrication and processing which in turn reduces chances for errors.

When All-ceramic crowns are fabricated conventionally, the ceramic is cast from ceramic ingots or shaped from firing porcelain powder. Therefore, distortions that occur during the manufacturing process will adversely affect crown fitting. These distortions include Influence of firing cycles and the effect of the veneering layer(s). This is a conspicuous disadvantage of the double-layer type of CAD/CAM crown materials (LAVA and DENTCARE). Conversely, the IPS e-max does not require conventional laboratory works[26].

One of the major objectives of tooth restoration is the protection of exposed dentine against bacteria and their toxins. The interface between the restoration and dental hard tissue is an area of clinical concern as insufficient sealing can result in marginal discoloration, secondary caries, and pulpitis. For that reason, adequate sealing is essential for optimal clinical performance.[26]

In this study microleakage was measured as scores, in which IPS e-max group materials showed the lowest mean value of **(2.10±0.31)** whereas LAVA group materials and DENTCARE group materials showed a mean value of **(3.10±0.32)** and **(4.00±0.00)** respectively. There was significant relation between groups and this may be due to the effect of the dual cure resin cement.

When these results were analyzed, the lowest microleakage observed for IPS e-max system (group I) may be due to the pressable ceramic that is subjected to a less firing cycles than that for LAVA (group II) and DENTCARE (group III) which is double layered computer-aided design/computer-aided manufacturing material system.

When the results were subjected to statistical analysis the LAVA (group II) showed less microleakage when compared to DENTCARE (group III).

The above findings showed that value obtained for microleakage is least for IPS e-max and highest for DENTCARE zirconia.

Microleakage can be related to margin misfit, although no strong correlation between margin fit and microleakage scores in complete crowns has been demonstrated. Marginal opening did not directly correlate with marginal microleakage. Also, the authors stated that a complex interaction between variables related to dental restoration, luting agent, and tooth structure probably influenced microleakage[21].

The results in the stereomicroscopic section showed the penetration of stains between the restoration and the tooth surface (fig27-33) It could be due to the luting agents used (self-adhesive). Self-adhesive luting agents have been shown to be less soluble, biocompatible, and bacteriostatic.

To explain this, Fick's first law of diffusion states that "the rate of material dissolution is independent of the exposed area (amount of luting agent)". Correlation values between misfit and microleakage were low because the gap formation at the tooth cement interface partially accounts for the microleakage values observed.

From the above findings the marginal gap is more seen in zirconia when compared to IPS e-max. Among the zirconia crowns DENTCARE zirconia showed more marginal gap when compared to LAVA zirconia crowns.

It is also observed that the microleakage is more in zirconia than IPS e-max. Among the zirconia crowns DENTCARE zirconia showed more microleakage than LAVA zirconia crowns.

SUMMARY AND CONCLUSION

In the present study, marginal adaptation and microleakage of IPS e-max, LAVA Zirconia and DENTCARE Zirconia were evaluated. Maxillary first premolar was prepared to receive All ceramic restoration. It was duplicated using addition silicon impression material (Aquasil - Dentsply, Germany) for fabricating Cobalt – Chromium metal die, which is used as a master die. Using the master die, 30 heat cure acrylic samples (DPI – India) were fabricated. 30 all ceramic crowns (10 IPS e-max, 10 LAVA Zirconia and 10 DENTCARE Zirconia) were fabricated for the heat cure acrylic tooth models.

Self-adhesive resin cement (RelyU X U200 – 3M, Germany) is used for luting the All ceramic crowns. After 24hrs luted crowns were immersed in distilled water for 24hrs, and then the samples were transferred to methylene blue solution (0.1%) for 24hrs. Samples were retrieved from the solution using sterile tweezer and kept for drying for 48hrs. Dried samples were sagittal cross sectioned using diamond wheel disc of thickness 0.01 mm.

Scanning Electron Microscopic study (Sree Chitra Tirunal Institute of Medical Science and Technology) for evaluating marginal adaptation of all three groups, and Stereomicroscopic analysis (Sree Chitra Tirunal Institute of Medical Science and Technology) for evaluating microleakage of all three groups were observed.

The following conclusions can be drawn from this study:

1. The Scanning Electron Microscopy analysis of samples showed marginal gap in all the three groups.
2. The Scanning Electron Microscopic results showed the least marginal gap in IPS e-max (Group I) than the other two groups.
3. The Scanning Electron Microscopic results showed more marginal gap in LAVA Zirconia (Group II) than IPS e-max (Group I).
4. The Scanning Electron Microscopic results showed more marginal gap in DENTCARE Zirconia (Group III) than Group I and II.
5. The Stereomicroscopic analysis of samples showed microleakage in all the three groups.
6. The Stereomicroscopic results showed the least microleakege in IPS e-max (Group I) than the other two groups.
7. The Stereomicroscopic results showed more microleakage in LAVA Zirconia (Group II) than IPS e-max (Group I).
8. The Stereomicroscopic results showed more microleakage in DENTCARE Zirconia (Group III) than Group I and II.

From the above findings, it can be concluded that IPS e-max showed better marginal adaptation and least microleakage than LAVA ZIRCONIA and DENTCARE ZIRCONIA.

The long term stability and functionality of the all ceramic crowns is our definitive goal. Marginal adaptation and microleakage plays an important role in survival of the restoration and esthetics.

FUTURE RESEARCH

In this research, the marginal adaptation and microleakage were evaluated. The study was conducted in two types of zirconia crowns with that of one type of pressable glass ceramic crown, while the samples were luted with self-adhesive resin cements. Different fabrication methods, systems and luting techniques are available. Therefore, further studies based on additional variables should be conducted to verify the marginal adaptation and microleakage.

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